THE

COMPLETE FARMER;

OR,

GENERAL DICTIONARY

OF

AGRICULTURE AND HUSBANDRY.

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OF

AGRICULTURE AND HUSBANDRY:

COMPREHENDING

THE MOST IMPROVED METHODS OF CULTIVATION;

THE DIFFERENT MODES OF RAISING

TIMBER, FRUIT, AND OTHER TREES;

AND THE

MODERN MANAGEMENT OF

LIVE-STOCK:

WITH DESCRIPTIONS OF THE

MOST APPROVED IMPLEMENTS, MACHINERY,

AND

FARM-BUILDINGS.

THE FIFTH EDITION,

WHOLLY RE-WRITTEN AND ENLARGED.

VOL. I.

LONDON:

PRINTED BY RIDER AND WEED, LITTLE BRITAIN,

FOR R. BALDWIN; W. J. AND J. RICHARDSON; F. C. AND J. RIVINGTON; J. CUTHELL AND MARTIN; W. LOWNDES; W. OTRIDGE AND SON; LONGMAN, HURST, REES, AND ORME; CADELL AND DAVIES; J. STOCKDALE; LACKINGTON, ALLEN AND CO; B. CROSBY AND CO; CLARKE AND SONS; P. AND W. WYNNE; AND J. BOOKER.

1807.

By these, and various other, means, a large stock of important materials on Rural Affairs has been submitted to the attention of the farmer in numerous publications and journals; which, with those contained in the voluminous writings of the more ancient cultivators, constitute a body of knowledge on the Science of Agriculture, that obviously required much arrangement and method to render it extensively beneficial to the public.

This has been attempted in the present work, in which all the circumstances that seemed the most natural to the subjects have been regularly digested under the heads to which they appeared properly to belong, so as to constitute a sort of Essay on each.

As there is scarcely any branch of knowledge which embraces more local or provincial terms than that of husbandry, it has been the business of the editor to define and explain them as much as the nature of the undertaking would admit, and he is willing to hope, that little has been overlooked in this respect.

It may be observed, in regard to the work itself, that although formed on the plan of a former publication of the same nature, yet, from the great length of time which has elapsed since that was offered to the public, it has been found to contain but little that appeared worthy of being retained; consequently the present may, in fact, be considered as altogether a new work.

The nature of a Dictionary is now too well known to admit of any thing new being said upon it; but it may be observed, that though, unlike a regular system or treatise, it may divide and separate the parts of the subject, it has nevertheless much the advantage in point of reference and definition.

In respect to himself, the editor has only to state, that, in putting the materials together, it has been his endeavour to render the work as practically useful

as possible, by omitting no details of practice that came in his way upon any article of real importance to the farmer. He has also to remark, that the value of the publication will be found to be greatly enhanced by the numerous well-executed engravings which accompany it, and which will convey to the practical farmer, and other cultivators of the soil, a correct idea of all the most material improvements which have of late been introduced into every kind of agricultural implements and machinery.

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ABACA, a sort of hemp or flax much cultivated in the Philippine Islands, of which there are two kinds, the white and the grey; from the former a very fine linen is woven, but the latter is chiefly used in the making of ropes and cordage.

ABELE-TREE, a name frequently applied to the white poplar. It grows naturally in most temperate climates; and may often be cultivated to great advantage on the poorer sorts of wet soil, where many other kinds of trees are incapable of being raised. See *Poplar*.

ABHOL, a term sometimes applied to the shrub usually known by the name of *savin*.

ABIES, a term used to signify the fir or pine. See *Fir-tree*.

ABLACTATION, the weaning of an animal from sucking or the taking of milk.

ABORTION, in *farriery*, the premature expulsion of the young of any brute animal. It is an accident, that, except from some external violence, as a blow, fall, &c. seldom happens to brutes, in consequence of which, either the fœtus is destroyed, or the secundines detached from the womb; and a premature birth, generally of a dead animal, takes place. In this case, farriers have often injured the mother by the injudicious and unnecessary administration of violent forcing medicines, such as helebore, capsicum, &c. Nature is however generally equal to the perfect restoration of the animal, without any other assistance than a warm mash of scalded bran, and comfortable accommodation in the stall. The signs of approaching abortion, are, great uneasiness and restlessness, and a discharge of a bloody nature from the parts of generation.

ABORTIVE CORN, a distemper in grain, noticed by Mr. Tillet, which, he asserts, shows itself long before harvest, when the stalk is not above eighteen inches high; and may be known by a deformity in the stalks, the leaves, the ears, and even in the grain.

The stems of abortive corn plants are generally shorter than those of healthy ones of the same kind and age: they are crooked and knotted; the leaves being commonly of a bluish green colour, curled up in various forms; sometimes turned like wafer-cakes, and often rolled in a spiral form. The ears have very little of their natural form; they are lean, withered, and show very imperfect rudiments of either the chaff or grain.

These appearances are, however, only to be observed in plants that are highly diseased. The stalks are often pretty straight, the leaves but little curled, and the chaff tolerably well formed; but instead of enclosing a small embryo, white and soft at the summit, it contains only a green kernel, terminating in a point, not unlike a young pea when forming in its pod.

These abortive kernels have two or three points very visible; and are formed in a manner as if two or three kernels were joined together at the base. When they are ripe, or rather when dried up, they grow black, and resemble the seeds of cockle so much, that farmers who are not acquainted with this distemper, often confound abortive wheat with the seeds of that weed.

It is supposed by the author just mentioned, that this disease is occasioned by the perforations of insects, as he perceived on the sickly plants small drops of a very limpid liquor, which he imagined to be extravasated sap.

ABRAUM, a name sometimes given to a kind of red earth, bole or clay, employed by cabinet-makers, and others, to deepen the colour of new mahogany wood. It is mostly brought from the Isle of Wight, but is found in other places, as in Italy and Germany.

ABROKUS, a term employed by some old authors for the *bromus*, or *avena sterilis*, or wild oat; and by others, for the *orobus*, or bitter vetch.

ABSCESS, in *farriery*, a collection or gathering of pus or matter in any part of an animal, arising from inflammation. Its approach is shown by a continuance and increase of all the symptoms attendant on inflammation, notwithstanding the endeavours used to disperse it; a greater elevation and more palpable circumscription of the tumor; with rigors or cold shiverings.

Horses are not more liable to this disease than other quadrupeds. Some have imagined that the matter or pus in an abscess is produced partly by an alteration made in the fluids of the part, and partly by the breaking down of the over-distended capillary vessels, the dissolution of the fat, and of other substances about the tumor; all which are said to be blended with the altered fluids of the part. Others have contended that suppuration is a kind of fermentative process carried on in the fluids of the part affected; while others again consider it to be a secretion of a peculiar nature. But whatever may be the mode of formation of the fluid, the nature of it when formed, is a circumstance to be determined by our senses: good pus is a cream-coloured, bland, homogeneous fluid, devoid of smell. But this relates more particularly to pus in a sound state; as it may become altered or acrimonious in its nature, when it certainly cannot be considered so very inoffensive a fluid. It is also frequently found mixed with blood and other fluids, when it loses its cream colour and becomes of a dark, dirty, brown hue; in which case, it is called purulent sanies. In other instances it loses its consistence, is much thinner than it ought to be, its colour inclines to yellow, somewhat resembling serum, and in this state it is termed *ichor*. These two last are unfavourable states of it.

These tumors are usually divided, with respect to their situation, into internal and external. The former, when they affect the cavity of the head, chest, belly, or any of the joints; the latter when they have their situation in any of the exterior parts of the body. The latter may also be subdivided into deep seated, or such as are under the fascia of the muscles; and superficial, or such as are situated in the cellular and adipose membranes, or among the common integuments immediately under the skin; which differences require a considerable diversity in their mode of treatment.

In regard to their nature, they may also be distinguished; into abscesses of the glands, which may occur in any of the lymphatic glands of the body of an animal; and into critical abscesses, or such as happen after acute diseases, supplying the place of that critical resolution by which the disease, in its natural progression, might have been remedied.

After it is ascertained that pus is collected in any part, and forms what is termed an abscess, that fluid must be considered as an extraneous body, and the first general consideration is to procure a speedy vent for it. But it is a general rule, not to make an opening till that matter is fully known to be formed, and in some cases, not till there is a certainty of the abscess being in a state of maturity.

In deep seated abscesses, the signs mentioned above are not so very evident as in the superficial ones. Habit must therefore greatly assist the veterinary surgeon in forming a determination; as by frequently seeing and touching deep-seated abscesses, he becomes sensible of the fluctuation, tho' deep. He must not, however, fail to attend particularly to the mode of their formation and progress. Whenever a soft tumor, though not having all the common signs, shall have been formed with great pain, and when it has come on after some external violence or acute distemper, there is good reason to conclude that matter is at least forming in the part. There is, however, one farther point to be considered, which is, by what criterion a judgment may be formed, whether the matter in these deep seated abscesses be completely formed or not, or in fact, whether it be the proper time to give vent to it. The chief point to be attended to in this case is, that the animal will shew signs of greater pain and fever *while the matter is forming*, than when it is completely formed.

When, therefore, after the signs attending tumors, mentioned above, and particularly after those of shiverings, a remission of the violence of the symptoms is observed, without any sensible diminution of the volume of the tumor, or rather, perhaps, with an increase of it, it may be concluded that the matter is completely formed. This rule, however, though very extensive, is not applicable to every possible case; as there is one or two instances in which scarce any other criterion is found to judge of the existence of matter, or of the necessity of opening by, except the violence of the pain.

The next thing to be considered, is the discharge of the matter, which may be effected in three different ways; by nature, by incision, and by a seton or cord; all of which may be proper occasionally under different circumstances.

Where the abscesses are superficial, or seated in the cellular fatty membrane above the fascia of the muscles, particularly when not of any considerable extent, there can in general be no harm in leaving them to nature, so as to let them burst of themselves. The proper application to an inflamed abscess advancing to suppuration, is something of the emollient kind, that may keep the parts as supple and easy as possible. Poultices made of oatmeal and lard, may be applied, or those with boiling water and linseed cake powder, after being boiled together and properly secured by bandages on the part, which should first be well soaked in warm water, or fomented with flannels wrung out of it. And in these cases the same application may be continued after the tumor has burst, and if there be any induration existing in the surrounding parts which does not give way in a few days to such emollient cataplasms, the addition of a small portion of mercurial ointment spread on the surface of the poultice often greatly assists in soften-

ing it. This method should be continued till all the matter is evacuated, and all the inflammation and hardness dispersed; when it may be proper to lay aside the emollients, and cover any little sore that may remain with a pledget of basilicon, making use of pressure by bandage to hasten the consolidation of the parts that have been affected.

When the seat of the abscess is in the glands near the skin (which is also a superficial abscess), it may be necessary to make use of more stimulating applications; as, in these cases, the suppuration is generally very slow, and requires to be hastened. Poultices of pollard, boiled turnips, &c. with a portion of turpentine, answer this intention. See *Poultice*.

But where such abscesses are of any extent, it will frequently be found, that the opening made by nature will not be sufficiently large to evacuate the matter. There will, therefore, be a necessity of making an artificial opening, and the best mode of doing this is by a free even incision with a clean-cutting knife. It should be made without any regard to the direction of the muscular fibres, in the longest axis of the tumor.

When this kind of abscess requires an opening on account of its size, it is observed by a late writer, that it may likewise "be punctured as early as the matter is formed; and although there should be some little hardness, it need not hinder the operation, as that will easily be resolved in the course of the cure. In general, where it is necessary from the size of a superficial abscess to open it, the sooner the opening is made the better, as it puts a stop to the progress of the disease, and prevents the skin from being thinned to a considerable extent, so as to occasion the subsequent loss and destruction of it. But when the abscess happens in the superficial glands, it is much better, if possible, never to open it by artificial means; because, as the cure of the distemper depends upon the melting down of the whole substance of the gland, the longer the pus is permitted to sojourn in the part, the more completely will this effect be obtained."

Where glandular abscesses are so large as to require opening, it will, however, occasionally happen that the best mode of doing it may be by a seton; as the object is not to save, but destroy the affected part. See *Seaton*.

In deep seated abscesses under the fascia of the muscles, where there is in general no affection of the skin, when the tumors do not advance kindly to suppuration, instead of the suppurative cataplasm recommended in the other sorts of abscesses, warm stimulating liniments may be employed. See *Liniment*.

But in such deep seated abscesses a very different mode of treatment from that recommended for the superficial ones must be employed. In the latter, although, when an opening is required, it may be useful to have recourse to it early, yet no great danger can attend a little delay, especially as it has been seen that some of them might be left to burst of themselves: but, in the deep seated kind, however small the extent of it, not only the case can never be cured without an artificial opening, but it is of the utmost consequence that this opening should be made as soon as the matter is found to be actually formed.

The matter being surrounded on the fore part of the tumor, by a strong inelastic tendinous expansion, forming a considerable resistance to the distending power of the fluid within; so that, until this resisting fascia be stretched to such a degree as to break, the matter cannot possibly come forward to the skin; while the back part and sides of the abscess are of a very different nature; consisting either of soft muscular fibres, connected with yielding cellular membrane, proper either to be destroyed by the pressure of the incumbent fluid, or to transmit it through the interstices of the muscles, so as to form holes, or *sinuses* for it, which extends the mischief to the neighbouring parts, or perhaps diffuses it through the whole of the limb; or they may be thin membranes, as in the instance of an abscess under the fascia of the muscles of the belly, where sooner than the strong tendinous expansion will burst, the matter pierces the peritoneum and evacuates itself into that cavity, where it must generally prove fatal. Or, lastly, it may be seated near the surface of some bone, where if it be suffered to remain, a caries may be the consequence. From these various circumstances, the necessity of making an early opening is obvious, and it is likewise evident, that the opening should be by incision. It is proper, indeed, that these deep-seated abscesses should be opened very largely, and that the fascia covering them should be freely divided, in order that the operator may get fairly at the bottom of the abscess, so that if there be any sinuses running among or between the interstices of the muscles, he may either be able to lay them open, or, by tracing the direction in which they run, make counter-openings wherever they may be found requisite.

In the inside of most abscesses, portions of cellular or adipose substance, or perhaps of separated coagulable lymph are found, which do not make part of the parietes of the cavity, but run through the middle of it, forming so many little bars of flesh, passing across from one side of the abscess to the other. These must be searched for with the finger, and wherever found, be divided with the knife.

This rule of the early opening of deep-seated abscesses, though founded on theory, is well supported by practice; as, by opening such abscesses early, they have sometimes been cured, though extremely large, in a month or six weeks; while other tumors of this nature, which, from their slow progress in the early stages, have been either neglected, or suffered to come forward, have kept the animal six months under treatment, in imminent danger of its life.

But this rule of opening such deep-seated abscesses as early as possible, is, however, exceptionable, in the case of critical abscesses, or tumors formed to carry off the remains of something morbid from the system. In these cases, it is often proper to wait till the inflammation appears to be pretty high, and till the disease of the habit seems to be wholly transferred to the part; which may be distinguished by the change from a very morbid and sickly, to a more healthy and promising state of general health; while, at the same time, the swelling continues to advance. In general, the turn and progress of the disease may be waited for; unless there should be some circumstance, of material consequence, which indicates a contrary intention: as, when there

is reason to apprehend that the matter may make its way either into the cavity of the thorax or abdomen, or injure some part of consequence. There may be some cases, likewise, where the critical suppuration is going on very slowly, to the utmost hazard of the animal's life, and where the part seems to require an additional stimulus. In such kinds of slow critical tumors, blisters may be applied, or some of the matter may be let out, by passing a seton, when practicable, through the abscess, which, by continuing to discharge for some time, may expel the disease.

It is likewise a general rule, in the treatment of abscesses, to lay open all the *sinuses* and *cavities* belonging to them, when practicable and necessary; but there are some cases in which it is needless, and others where it is impossible. For instance, it is scarcely ever necessary to open superficial or cutaneous sinuses, the direction of which is upwards, from which the matter may be readily discharged, and which may afterwards be cured by a proper compress and bandage. Where it happens that the *bottom* of the sinus is situated in a depending part, and the opening of it above, when it may be impossible to force out the matter by compress and bandage, it becomes absolutely necessary either to lay open the sinus its whole extent, or to open the bottom of it, and pass a seton through the rest. These sinuses, when neglected, become fistulous, and require a distinct mode of treatment. See *Fistula.*

When superficial abscesses are opened, the matter should be pressed out very gently; as it is a bad practice to squeeze the parts with violence, in order to press out the whole of the matter contained in them.

In abscesses of this sort, which have been left to break of themselves, nothing should be applied, but *emollient* poultices, without any tow or other intervening substance. And to those which have been discharged by an incision, little else is necessary, provided the size of the opening has been in proportion to that of the cavity. *Tents*, thrust into the aperture, prevent the matter from flowing out as it is formed, and are therefore pernicious; at the same time, as the powers of restoration in brute animals are particularly strong, some soft tow may be introduced with a probe at the *upper* and *lower* ends of the wounds, to prevent their healing outwardly before the cavities are filled up firmly with new flesh. They may likewise, in some cases, be dressed by some mild digestive ointment. If, under this treatment, they become sluggish, and do not heal, some stimulating application may be made use of, with advantage, carefully preventing the new granulations of flesh from rising too high, by some caustic substance.

These tumours may be prevented by such means as have a tendency to lessen inflammation. See *Inflammation.*

ABSORBENT, a term applied to such fine vessels, terrene matters, as possess the faculty or power of *absorbing* or drinking-up liquid or other substances.

ABSORBENT EARTHS, such earthy substances as, when mixed and united with soils, possess the property of taking up their moisture, and rendering them more dry and friable. Hence, under certain restrictions, they are better adapted to the wetter and more moist kinds of land, than such as are of a dry and pulverulent quality. The matters that may be employed in this way, are extremely numerous; but those that are most commonly in use are lime, chalk, calcareous marle, &c. See *Calcareous Earth.*

ABSORBENT MEDICINES, in *farriery*, are such remedies as are principally composed of testaceous, chalky, or other matters of the same kind, and which possess the power of absorbing or correcting the superabundance of acid in the stomachs or bowels of animals, when administered internally. See *Chalk.*

ABSORBENT VESSELS, in *animals*, the fine vessels opening on the different cavities destined to take up the nutritive or other fluids; being denominated, according to the liquids they convey, *Lacteals*, or *Lymphatics*; the former conveying the chyle, a milky liquid, from the intestines; the latter, lymph, or a thin pellucid liquor, from the places from whence they take their origin; or any fluids that are extravasated, and convey them into the circulating blood. And, in *vegetables*, those fine vessels suited to imbibe their nutriment and support. It is observed by Dr. Darwin, in his Phytologia, that the existence of that branch of the absorbent vessels of vegetables, which resembles the lacteals of animal bodies, and imbibes their nutriment from the moist earth, is evinced by their growth, so long as moisture is applied to their roots, and their quickly withering when it is withdrawn. But besides these absorbents in the roots of plants, there are others, which open their mouths on the external surfaces of the bark and leaves to absorb the moisture of the atmosphere, resembling the cutaneous lymphatics of animal bodies; the existence of these is also shown, he thinks, because a leaf plucked off, and laid with its under side on water, will not wither so soon as if left in the dry air. The same if the bark alone of a branch, which is separated from a tree, be kept moist with water. And a third branch of absorbent vessels opens its mouths on the internal surfaces of the cells and cavities of the vegetable system to absorb the secreted fluids, after they have performed their adapted offices, similar to the cellular lymphatics of animal bodies, as may be shown by moistening the alburnum or sap-wood, and the internal surface of the bark of a branch detached from a tree, which will not then so soon wither as if left in the dry air unmoistened. And another means of demonstrating the absorbent powers of the parts of vegetables is, he observes, by inserting them into glass tubes, or into tall narrow vessels filled with water, and observing how much more rapidly the surface of the water subsides than in similar vessels by evaporation alone.

The doctor, by the following experiment, made these vegetable absorbent vessels agreeably visible even by a common magnifying glass. He placed, in the summer of 1781, some twigs of a fig-tree, with leaves on them, about an inch deep in a decoction of madder *(rubia tinctorum)*, and others in a decoction of logwood *(hæmatoxylum Campechense)*, along with some sprigs cut off from a plant of picris. These plants were chosen because their sap or blood is white. After some hours, and on the next day, on taking out either of these, and cutting off from its bot-

tom about an eighth of an inch of the stalk, an internal circle of red points appeared, which he believed to be the ends of absorbent vessels coloured red with the decoction, and which he thinks probably existed in the newly-formed alburnum or sap-wood, while an external ring of arteries was seen to bleed out hastily a milky juice, and at once evinced both the absorbent and arterial system of plants.—A variety of similar experiments have been made by M. Bonnet, by placing parts of the stems or roots of various vegetables, as of kidney-beans, peach-tree, and elder, in dilute ink; in all these the vessels of the bark were uncoloured, and those of the pith; but those beneath the bark, which he terms woody, were coloured black, which Dr. Darwin supposes to have been the circle of absorbent vessels just described.

By Malpighi, Grew, and some other philosophers, these absorbent vessels have been denominated bronchia, and erroneously thought to be air-vessels; in the same manner as the arteries of the human body were supposed to convey air by the ancients, till the illustrious Harvey, by more exact experiments and juster reasoning, evinced that they were blood-vessels. This opinion has been so far credited, because air is seen to issue from wood, whether it be green or dry, if it be covered with water, and placed in the exhausted receiver of an air-pump; and these vessels have therefore been supposed to constitute a vegetable respiratory organ; but it may be shown that the leaves of plants are their genuine lungs, and that the absorbent vessels and arteries become accidentally filled with air in the dead parts of plants. For, as the vessels of vegetables are very minute, and have rigid coats, their sides do not collapse when they are cut or broken, as their juices flow out or exhale; they must therefore receive air into them. This, Dr. Darwin says, may be readily seen by inspecting with a common lens the end of a vine-stalk two or three years old, when cut off horizontally. At first the vessels, which are seen between the partitions radiated from the centre, appear full of juice; but in a minute, or less, this juice either passes on, or exhales; and the vessels appear empty, or only filled with air. This experiment, he observes, he has twenty times repeated with uniform success; and that it is so easily made, by hastily applying a common lens after the division of a vine-stalk, that he thinks there can be no error in it; and he considers it as wonderful, that these vessels, which are found in the alburnum, and consist of a spiral line, whether they may properly be called absorbent or umbilical vessels, or consist of both, should ever have been supposed to be air-vessels or tubes; yet there is, he observes, an experiment, made by Dr. Hales, which would at first view countenance the assertion, that vegetables absorb air. He cemented the lower end of a small twig of a tree, with leaves on it, into a glass tube about four inches long, and set the other end of the tube an inch deep in water, and observed, in a little time, that the water rose an inch in the tube; but this must happen from the vegetable vessels emptying themselves by the ascent of their juices; and having rigid coats, and therefore not contracting, a portion of the air was forced into them by the pressure of the atmosphere, as in the above observation on the vine-branch cut horizontally.

This reception of air does not happen to the vessels of animal bodies, when they are emptied of their blood, owing to the less rigidity of their coats; whence the weight of the atmospheric air presses their sides together, and closes the vessel, instead of passing into it. In the same manner, no air would pass into the vessels of the lungs of animals in respiration, unless the pressure of the atmosphere on their sides was prevented by the action of the muscles, which enlarge the cavity of the thorax, by the ribs being elevated. See *Air-Vessels of Vegetables.*

But the absorbent vessels of trees, in passing down their trunks, consist of long hollow cylinders, whose sides Dr. Darwin believes to be composed of a spiral line, and are of such large diameters in some vegetables as to be visible to the naked eye, when they become dry and empty, as in cane. Air will rapidly pass through these vessels in either direction, as may be seen in lighting a cane some inches long at either end, and drawing the smoke through the pores of it into the mouth, as through a tobacco-pipe. Dr. Hales readily passed both air and water through a recent vegetable stick, both upwards and downwards, by setting one end of it in a cup of water in the receiver of an air-pump, and exhausting the air; whence he concludes, with Grew, that these are air-vessels or lungs for the purpose of respiration, and that they receive atmospheric air in their natural sate. But the Doctor thinks there is one objection to their use as air-vessels, which is, that they have no communication with the horizontal air-vessels of plants; for, by blowing forcibly through a piece of dry cane, immersed deep in water, no air is seen to bubble out of the sides, but only from the bottom of it. It may indeed be supposed, that the longitudinal cavities in dry cane may not consist of the absorbent vessels above described, but of the interstices between them, as the coats of those absorbent vessels, consisting of a spiral line, may be thought to close up by their vermicular contraction; and their interstices, consisting of vegetable cellular membrane, may be supposed, when dry, to become the tubes in cane. But in this case, the longitudinal canals in dry cane would not be circular cylinders, whereas they are so represented in a figure of a piece of cane much magnified by Dr. Grew, who has, in the same figure, given the mouths of horizontal air-vessels of a circular form and larger diameter. But another insuperable objection to this idea of their use is, that these vessels equally exist in the roots of plants as in their trunks; and, according to Malpighi, with larger diameters, and probably terminate externally only in the roots; and, as they are not exposed to the atmosphere, they cannot serve the purpose of respiration; air, nevertheless, in its combined state, or even as dissolved in water, may be absorbed by these vessels; and may appear, when the pressure of the atmosphere is removed in the exhausted receiver, or when expanded by heat, as is seen in the froth at one end of a green stick, when the other end is burning in the fire. But these vegetable absorbents differ from those of animals in the facility with which they carry their fluids either way; for a forked branch of

a tree, torn from its trunk, and having one of its forks with the leaves on it inverted in a vessel of water, will continue for several days unwithered, nearly as well as if the whole had been placed upright in the water. A willow rod, on the same account, will grow almost equally well, whether the apex or base of it be set in the ground; and Dr. Bradley mentions a young gooseberry-tree having been taken up, and re-planted, with its branches in the earth, and its roots in the air; and that the branches put forth root-fibres, and the roots put forth leaf-buds. There is likewise a curious experiment by Dr. Hales, who attached the eastern branch of a young tree to its neighbour by inarching, and its western branch to another of its neighbours in the same manner; and after they were united, he cut the stem of the middle tree from its root, and thus left it hanging in the air by its two inarched arms, where it flourished with considerable vigour. This power of carrying their fluid contents in a retrograde direction, the Doctor observes, is also possessed in some degree by the absorbents of animals, particularly in their diseased state, and even in the operation of an emetic, as shown in Zoönomia, vol. 1. sect 29. and is visible in the œsophagus or throat of cows, who convey their food first downwards, and afterwards upwards, by a direct and retrograde motion of the annular cartilages, which compose the gullet, for the purpose of rumination or chewing the cud.

The Doctor thinks that the structure of these large vegetable absorbents, erroneously called air-vessels, probably consists of a spiral line, and not of a vessel interrupted with valves, and differs in this construction from animal lymphatics; for, first, on breaking almost any tender vegetable, as a last year's sprig of a rose-tree, or the middle rib of a vine-leaf, and gradually extending some of the fibres, which adhere the longest, this spiral structure becomes visible even to the naked eye, and distinctly so by the use of a common lens, as is delineated in Duhamel's Phisique des Arbres, and Grew's Anatomy of Plants; and by this easy experiment, both that absorbent system, which imbibes nourishment from the earth, and brings it to the caudex of each bud; and that which imbibes moisture from the air, and a part of the perspirable matter on the surface of the leaf, and brings it to the caudex of each bud; are agreeably demonstrated. And that these vessels of large diameter, with their sides consisting of a spiral line, are not arteries or veins, is evinced by inspecting a stem of euphorbia, spurge, or the stalk of a fig-leaf, immediately on dividing them, as the milky juice oozes from a ring of vessels exterior to those large absorbents. And, secondly, that these vessels are not furnished with frequent valves, is countenanced by the experiments before mentioned, one of which consisted of lighting a piece of cane, and drawing the smoke through it, as through a tobacco-pipe, in either direction; and the other, in placing a bit of recent twig, with one end of it in a cup of water, in the receiver of an air-pump, and causing both air and water to pass through it in either direction.

Should the minuter branches of vegetable absorbents be of a similar structure, it is easy to conceive how a vermicular or peristaltic motion of the vessel, beginning at the lowest part of it, each spiral ring successively contracting itself, *till it fills up the tube*, must forcibly push forwards its contents without the aid of valves; and if this vermicular motion should begin at the upper end of the vessel, it must with equal facility carry its contained fluid in a retrograde or contrary direction. For as the absorbent vessels in the roots of plants are protected from the frost in some degree by the earth which covers them, they seem at all times to be sufficiently alive to drink up and push forwards their adapted fluid; since, if a branch of a tree is brought into a warm room, it will in general pullulate in the winter, as soon as the vessels of the upper part of the branch are rendered sufficiently irritable by warmth to act in concert with the absorbents of the root. Nevertheless, in severe frosts, it is necessary to guard all the parts of the stem which is exposed to the open air, as is experienced in the vines brought through holes into hot-houses; otherwise, after the buds are put out, a severe frost so affects the stems on the outside of the house as to destroy all the fruit of that year. Kenedy on Gardening, vol. 1. p. 270. And it is observed by Mr. A. Aikin, that elm-trees are sometimes destroyed by the slow melting of ice.

It is further observed, that the absorbent vessels of vegetables, like those of animal bodies, are liable to err in the selection of their proper aliment; and hence they sometimes drink up poisonous fluids, to the detriment or destruction of the plant. Dr. Hales put the end of a branch of an apple-tree, part of which was previously cut off, into a quart of rectified spirit of wine and camphor, which quantity the stem imbibed in three hours, which killed one half of the tree. Veg. Stat. p. 43. Some years ago, Dr. Darwin sprinkled on some branches of a wall-tree a very slight solution of arsenic, with intent to destroy insects; but it at the same time destroyed the branches it was thrown upon. And he was informed by Mr. Wedgewood, that the fruit-trees planted in his garden near Newcastle in Staffordshire, which consisted of an acid clay beneath the factitious soil, became unhealthy as soon as their roots penetrated the clay; and, on inspection, it appeared, that the small fibres of the roots, which had thus penetrated the clay, were dead, and decayed, probably corroded by the vitriolic acid of the clay, beneath which is a bed or stratum of coals. It is, however, asserted by M. Buffon, that the roots of many plants will creep aside to avoid bad earth, or to approach good. Hist. Nat. vol. iii. But this is, perhaps, better accounted for, by supposing that the roots put out no absorbent vessels, where they are not stimulated by proper juices; and that an elongation of roots in consequence only succeeds, when they find proper nutriment or food.

These long and large cylindrical absorbent vessels, which pass from the roots of trees up to the summit of the caudex of each bud at the foot-stalk of the leaf, the Doctor supposes to be analogous to the receptacle of the chyle of animals, as the small absorbent branches of the roots probably unite beneath the soil into those large vessels which are so easily

visible: hence the caudex of each bud consists of an elongation of absorbent vessels, and of arteries and veins, reaching from the union of the root-branches to the foot-stalk of each leaf, and the plumula of the bud in its bosom.

In further proof that plants have a set of absorbent vessels, opening on the surface of their leaves, which draw moisture, or other matters, from the atmosphere, in the same manner that the radical ones do from the earth or soil, and convey it to other parts of the vegetables, it has been observed by many, that plants, grown tabid by the heat of the day, revive in the night-time by the dew, which cannot be attracted by any other organ than the leaves; that leaves, lying in the water, or upon its surface, preserve their greenness, but immediately become yellow, if spread over with oil or varnish, by which the absorbent vessels on the leaf are obstructed or closed up; and that the whole plant is enervated if deprived of its leaves. Finally, that the *cacti* and *seda*, though they have very small roots in proportion to their size, and grow on the driest hills, are extremely succulent. From the leaves of plants, and particularly the under surfaces of them, having innumerable *villi*, they also conceive that these *villi* are their absorbent vessels. And Dr. Darwin, from attentive observation and experiment, seems to conclude that these vessels of plants simply perform the office of absorption.

ABSORPTION, the power or means by which vegetables are enabled to draw food from the moist parts of the earth or soil in which they are placed. In farriery, it is also the means by which concretions and watery swellings in different parts of animals are frequently removed.

ABSTERGENT REMEDIES, in *farriery*, are those used for the purpose of resolving or discussing tumors and concretions on the joints and other parts of animals. They mostly consist of volatile, stimulant, and saponaceous matters.

ACACIA, a deciduous tree of the large ornamental kind. Its wood is not of much value as timber. See *Locust Tree.*

ACCOUNTS *Farm*. See *Farm Accounts.*

ACER, a genus of trees comprehending different species of the large deciduous kind, as the sycamore, &c. See *Maple Tree.*

ACERB, a sourish, austere, harsh taste, peculiar to the juices of some fruits and vegetables.

ACETARY, a soft substance, of a sourish taste, found in some fruits, as the pear, inclosed in a congeries of hard matters about the base.

ACETOSA, a term applied by some to sorrel. See *Sorrel.*

ACETUM, a term employed to signify the Vegetable Acid. See *Vinegar.*

ACHE, in *farriery*, a violent pain in a part, existing independently of any motion, swelling, or other apparent alteration; being, of course, an affection only to be discovered in brute animals, by the common signs of PAIN. The bones and joints of horses are often liable to aches, in consequence of having been hard ridden, and afterwards exposed to cold.

ACIDS, such substances as have a sour pungent taste, and which modern chemistry has shown to be formed by the combination of oxygen or pure air with certain bases, from which they derive their names. The presence of this acidifying principle is always necessary, in order to constitute an acid. See *Oxygenation.*

Thus, by the union of this air with sulphur and azote, or nitrogen, the sulphuric and nitrous acids are formed; and the acids produced from its union with the juices secreted by vegetables receive their titles from those of the vegetables themselves, or the parts from which they have been extracted: hence we have the gallic acid, the malic acid, and the oxalic acid, &c.

These substances possess the property of changing the blue colour of vegetables to red, and of combining readily with most earthy matters, alkalies, and metals. They are likewise formed from the decomposition of bodies, or other means, either upon the earth or in the soil. But in soils they are generally met with in the state of combination with saline or earthy substances, which possess different degrees of solubility, and which, of course, are more or less adapted to promote the growth of vegetables. Acids are also capable, from their different powers of affinity with different substances, of setting at liberty various gasseous and other matters contained in the materials of which soils are composed, and thereby expediting new combinations that are more or less favourable to vegetation. See *Particular Acids.*

ACIDUM ÆREUM, a term signifying the aerial acid, or fixed air. See *Carbonic Acid.*

ACORN, the well-known fruit of the oak.

Acorns are said to have been the primitive food of mankind; but at present they are principally used in raising young oaks, or for the purpose of fattening hogs, for which last they are said to be a very proper and useful kind of food.

In the vale of Berkeley, in Gloucestershire, according to Mr. Marshall, they are in high esteem among the farmers, who seem to be as anxious about them as their apples. They consider them as the best means of fatting hogs, and think they make the bacon firm, and weigh better than bean-fed bacon. The price of acorns there is from 1*s*. 6*d*. to 2*s*. per bushel, according to the season and the price of beans. Few are sold, however; every farmer collecting his own, or tending his pigs upon them.

Some care is necessary to be taken when hogs are fed upon acorns, for otherwise they will be subject to constipation, and the disease called the garget. These may however be avoided, by mixing laxative substances with them, and not allowing them to have too many given at a time; at first a few, twice a day, is often enough; afterwards three times a day. The hogs, while they eat this food, should not be confined to the stye, but be suffered to run at large; for if their liberty be too much abridged, they never thrive well or grow fat on this sort of food.

In Hertfordshire, it is no uncommon thing, with the management above directed, and the assistance of a little wash, and a few grains now and then, for a farmer to kill several hogs in a season, which weigh from eight to ten score, and sometimes even more. Hogs fed in this way make very good meat; but it is

not here thought by some so fine as when they are taken up, and four or five bushels of pease or barley-meal given to each, to complete their fattening.

When employed for raising oak timber from, the method of planting the acorns, which is practised by some, is to make holes to receive them at the distance of twelve or fifteen inches from each other, in an oblique direction, so as to raise up a tongue of turf, under which they are to be deposited, and where they require no farther kind of nursing. In the course of from twenty to thirty years, in this mode of planting, the spot, it is said, will be fit to be coppiced, that is, partially cut down as underwood, leaving the most healthy plants. The thinnings may be sold for railing, and generally fetch a good price. A better method is, however, to dibble them on land that has been properly prepared by ploughing or digging, which may be done by women, three or four within a square yard; or they may be sown broast-cast, when the surface is fine and moist, and rolled in with a light roller. The former is probably the better practice. They may likewise be set about the middle of November, by a land chain, a quarter of a rod asunder, and six inches apart in the rows; dibbling them in, zigzag, alternately on either side a line stretched tightly on the surface, with blunt-pointed dibbles, letting a little mould fall down to the bottoms of the holes, to prevent water lodging round them, and burying them about two inches beneath the surface. Each square rod, when planted in this way, takes 132 acorns, nearly a pint, when they are middle sized, which is equal to two statute bushels and a half on an acre. The expense of planting acorns in this manner is about 5*s.* an acre.

ACRE, a general superficial measure of land, containing, according to the statute, four square roods, of forty perches or poles, or one hundred and sixty square poles or perches, of sixteen feet and a half long in the whole. But this measure does not prevail in all parts of England; for though one hundred and sixty square poles or perches are allowed to be an acre, yet the length of the pole or perch varies from sixteen and a half to twenty-eight feet, in different counties, which constitutes what is generally called *customary measure*. Thus the *customary perch* in Staffordshire is twenty-four feet; in the forest of Sherwood twenty-one. In Herefordshire, the perch of walling is sixteen feet and a half; but a perch for digging twenty-one feet.

The acre is likewise divided into ten square chains of twenty-two yards each, or 4840 square yards.

Old farmers also estimate the acre of land by the proportion of seed used in sowing it; by which means it must vary in proportion to the fertility or barrenness of the soil; and hence in many counties of England they have two sorts of acres, distinguished by seed acres and statute acres.

The Irish acre is to the English as 196 to 121; for the number of poles in each are the same: but the Irish pole is twenty-one feet, whereas the English contains only sixteen feet and a half.

The Scotch acre contains four square roods; one square rood is forty square falls; one square fall thirty-six square ells; one square ell nine square feet and seventy-three square inches; one square foot one hundred and forty-four square inches. The Scotch acre is also divided into ten square chains. The measuring should be twenty-four ells in length, divided into one hundred links, each link $8\frac{928}{1000}$; so that one square chain contains 10,000 square links. The English statute aere is about three roods and six falls standard measure of Scotland. The Welsh acre is equal to two English statute acres.

The French acre, or arpent, according to Mr. Greaves's calculation, consists of 100 perches of twenty-two feet each, amounting to 48,400 square French feet, which are equal to 51,691 square English feet, or very near one acre, and three quarters of a rood, English measure.

ACREME, a quantity of land consisting of ten acres.

ACRIMONY *of vegetables*, a property in some, by which they excoriate and blister the tongue, mouth, or other parts of the body, on being applied to them. The nature of this sort of acrimony has not yet been sufficiently examined by chemical investigation; but Dr. Darwin supposes it to depend on a fixed essential oil. It seems to differ in some measure according to the nature of the plants, as in those which are supposed to possess an alkalescent property, and to be more prone to putrefaction than others; such as the common onion, water-cresses, cabbages, &c. a part of their acrimony is lost, by their being exposed to a boiling heat; while other kinds, as ginger, capsicum, arum, and such like, do not become much milder by undergoing that process.

The juice of the fungous excrescences of some trees possess so much acrimony as to be capable of blistering; and some kinds of *fungi*, or mushrooms, contain a juice or liquor of a very corrosive quality; and it is probably on this account that many of those which are commonly procured, disagree so much with the stomach when made use of as articles of diet. By being more perfectly stewed, or otherwise prepared by means of heat, they might most likely be rendered safe and nutritious. Much caution should however be used, even when thus prepared, in eating such sorts as are unknown.

ACTING MANAGER. See *Bailiff and Land-Steward.*

ADAPTER, in the management of bees, is a board to set the hives or glasses upon.

ADDER'S TONGUE, a pernicious weed growing in low moist meadows, where it is commonly hid among the grass. In this weed there arises, from a very low stalk, a single, thick, smooth, oblong leaf, from the bottom of which issues a kind of tongue, ending in a point, and indented on each side like a file.

ADDER-STUNG, is said of cattle when stung by adders, or bit by any venomous animal; to remedy which, the best application is probably vinegar, or a saturnine wash.

ADIT *of a mine*, the opening from which it is entered and dug, and through which the water and ores are conveyed away. It is nearly the same as *drift*, but distinct from *air-shaft*. Adits are commonly made towards the bottoms of hills, so as to be level with and answer to the bottoms of the shafts.

ADDLE EGGS, are those which have not been impregnated by the male of those birds from which they are procured.

ADULT, a term sometimes applied to such plants or animals as are full grown.

ADZE, an edge-tool of the ax kind, with a thin arching blade placed at right angles to the handle. It is a very useful instrument for many purposes of the farmer. See *Plate* II, *fig.* 2.

AERATION, the act or operation of impregnating earthy or other bodies with air.

Aeration *of soils*, the impregnating of them with air, either by ploughing and harrowing, or some other means of pulverization, by which, from the air being confined in the interstices of the mould, new combinations of different kinds are more readily formed. It has been ingeniously observed by the author of Phytologia, that, as soils in general not only contain carbon, and other inflammable materials, which are capable of uniting with oxygen, and thus producing the carbonic and other acids; but also water, which, by its decomposition, when in contact with confined air, affords ammonia or volatile alkali, by the union of its hydrogen with azote, and nitre by the union of its abundant oxygen with another part of the abundant azote or nitrogen of the atmospheric air; there is, he thinks, reason to conclude that one great use of turning over the soil with the plough or spade depends in a great degree on the production of these effects on the confinement of both the oxygen and azote or nitrogen of the air, in the pores or interstices of the soil. And it is added, that when atmospheric air is imprisoned in the cavities or pores of the soil, by stirring or turning over its surface, which must be in the greatest proportion when the soil is broken down into very small particles or fragments; and that when it is the least pressed down by animals trampling over it, it more readily unites, he believes, with the materials just noticed, than in its free state; which he conceives may be effected by double or triple chemical affinities or attractions. For as the atmospheric air consists of oxygen, azote, and the fluid matter of heat; if the heat which occasions the oxygen and azote of the atmosphere to exist uncombined in the form of gasses, be attracted from them by any other material, as they are confined in the cavities of the soil, they may by their near approach to each other combine into nitrous acid; or the oxygen in its fluid state, not in its aerial one, more readily unite with carbon, and from a fluid, not an aerial, carbonic acid, which we believe to be of so much utility in the growth of plants. And further that if any putrefactive process be proceeding, where atmospheric air is imprisoned in the above manner, in the cavities of the soil, and by the loss of its heat be converted from a gass to a fluid, that the azote may unite with the hydrogen of the decomposing water, or contribute to decompose it; and thus to form volatile alkali, which, like the nitrous acid, may either during the process of its formation, or after it is formed, be of essential service to vegetation, at the same time the oxygen given out from the decomposing water, may contribute like that of the atmosphere, to produce carbonic, nitrous, or phosphoric acid; and in this way render carbon, phosphorous, and the basis of nitre, capable of being taken up by the absorbent vessels of the roots of vegetables. And that when air is confined along with water, the bulk of the former is much reduced, which is supposed to take place in consequence of the decomposition of both the water and air, and the production of ammonia and nitrous acid effected; both of which are asserted to be beneficial in the growth of plants. It is likewise evident from the heat of hot-beds, that when oxygen unites with carbon, the heat of the atmospheric air is given out. And it is probable that it is emitted during the production of nitrous and phosphoric acids, which render the advantage of sowing seeds or grain as soon as possible after the soil is stirred extremely obvious. See *Pulverization*.

AFFINITY. See *Attraction*.

AFTERGRASS, the second crop of grass, or that which springs up after mowing, or the grass cut after some kinds of corn crops.

In the vicinity of London, most of the aftergrass or second crop is made into hay, and is of considerable value for the ewes of suckling lambs, and milch cows; but in having this crop, so as to make it sell well, great nicety is requisite; the nature of aftergrass being more soft, spungy, and porous, than the first growth, and consequently more liable to be hurt by rains. See *Hay*.

In the midland counties, their management of the feeding off aftergrass is in general judicious. It is commonly suffered to get up to a full bite before it is broken, and not turned in upon as soon as the hay is off, or suffered to stand until much of it becomes improper for the food of animals.

Two able rural œconomists, one in Lancashire, the other in Leicestershire, however, make a point of saving autumnal grass for spring feed, and contend that it is the most certain, and on the whole, the best spring feed yet known. This would seem to be a wasteful practice, at least in respect to the more forward aftergrasses. The forwardest ought certainly to be broken sufficiently early to be eaten, without waste, before winter sets in; and the latest, that is to say, the shortest, may be shut up for spring feed. If aftergrass be too long and gross, it is apt to lodge, and rot upon the ground in winter; therefore, on rich lands, it ought always to be more or less fed off before Michaelmas, in order to prevent its being wasted or lost in the winter.

In Middlesex, Mr. Middleton says, the aftergrass is generally let by the farmers at about ten shillings an acre, to be fed off by heavy cattle, until such time as the land would receive injury from their poaching, if they were continued on it; and after that by sheep, till Candlemas; and sometimes by the latter only, at about three shillings the score per week. This seems a good system for the wetter sorts of ground; but in the more dry soils, heavy stock may be continued much longer.

It has been found, from repeated experiments, as will be seen below, that such preserved aftergrass feeds sheep that give milk better than turnips, which last are more adapted to the fattening of that sort of

stock; and that such grass holds to a period, if wanted, when most other resources are deficient.

But however useful aftergrass-pastures may be under such management, there is evidently a great loss of food incurred by it, especially in severe winters: it would therefore seem to be, in general, the best practice to eat aftergrass well down, as late as possible in the autumn, by different sorts of animals, and depend upon new grass for spring feed.

It is remarked by the author of Practical Agriculture, that " In some districts much of the aftergrass is frequently cut and made into a green soft sort of hay, as has been already mentioned; but in others it is fed off by live stock in the autumn." And that, " Both modes may be useful under different circumstances. In situations where plenty of manure can be procured, as near large towns, and where the chief dependence is upon the sale of hay, or where lamb suckling prevails, it may frequently be a beneficial practice to take a second crop of hay, as the first may by that means be more fully spared for sale, the after-crop supplying the cows or other cattle that may be kept on the farm. But in cases where manure cannot be easily obtained, and there is no local practice carried on that particularly requires such sort of hay, it is better to let it be fed off by stock than run the risk of exhausting and injuring the ground by the taking off repeated crops. There is also another circumstance, he says, to be considered in this business, which is that of the state of the land in respect to dryness; as where it is low, wet, and very retentive of moisture, it may be often more hurt by the poaching of the cattle in feeding off the herbage, than by taking a second crop of hay." But that, " independent of these considerations, it may in general be a more safe and useful practice to eat off the aftergrass by stock, and only take one crop of hay, as by such means a more abundant annual produce may be afforded, and the land sustain less injury;" as has been shown in the Report of the State of Agriculture in the County of Middlesex.

It is however added, that " where a crop of rouen is made into hay, the most profitable application of it is probably in the foddering of such cows as are in milk; as it is well suited, by its grassy quality, and its not heating so much when well made as other sorts of hay in the stack, to afford a large flow of milk. It is this reason that induces the cow-farmers to cut their grass so many times in the summer. Another beneficial application of this hay is, as has been seen, in the feeding of such ewes as are employed in the suckling of house-lambs during the winter-season; the intention in this case is the same as in that of the preceding instance. There is another advantageous use to which this sort of produce may be applied, which is that of supporting young calves and all sorts of young cattle that are kept as store stock." And that, " where sheep require the support of hay in the winter season, it is also well adapted to that use."

The same writer likewise observes, that " where aftergrass is fed off by stock, there is much difference of opinion in regard to the most proper periods of turning in the animals. Some have contended that it is the best practice to let them into the field before the young grass has attained any very great head; while others maintain the opposite doctrine, and think it the best method to allow the grass to get up to a full bite before the stock is turned upon the land. Both endeavour to support their opinions by experience. But as they cannot be both of them true, it is probable that the extremes of each are to be avoided; and that, as in many other matters, the truth may lie in the middle. This is indeed equally supported by fact, and the observation of the most intelligent managers; as when the cattle are turned in too early, there is not a sufficient bite to keep up the condition of the animals; while in the contrary extreme, the stock so soon fill themselves, that much of it is trodden down and wasted afterwards in their roaming about the fields to pick the sweetest morsels." In confirmation of this opinion, he says, " Mr. Marshall found in the midland districts, that milch cows fell off in milk, and bullocks in flesh, on being put in too early, before there was a sufficient bite. This he, however, seems to consider as arising from the want of nutritious quality in the grass in this state. And the incautious observation of common farmers has ascribed it to the inconvenience the animals sustain in feeding from the stubs. It is not, however, probable, Doctor Dickson thinks, that either is the case; for as soon as the scythe has separated the old grass from the roots, new shoots are made that are highly sweet and nourishing. This may be easily perceived to be the case on examining a piece of ground soon after its being mown, and tasting the young shoots. The supposition respecting the stubs is shown to be founded in error, from the circumstance of the stock devouring the herbage with avidity, as Mr. Marshall has well remarked. Besides, the animals lick in their food by the tongue, which is armed for the purpose before it is bitten, and do not push their noses so as to be inconvenienced by the stiffness of the cut grass-stems. It is possible, however, that some effect in lowering the condition of the stock may arise from the laxative effect that may at first be produced on the animals by such young succulent grass." But, " where much stock is turned upon aftergrass in a full state of growth, there cannot be any doubt but that much loss must, as has been just observed, be sustained by the treading down and rendering the grass unfit for being eaten off. This is sufficiently evident, he thinks, on viewing fields fed in this state."

It is of course concluded, that " it is perhaps only by beginning the pasturage of aftergrass when in the middle state of growth, that it can be consumed to the best advantage, and without loss in either of the ways that have been just noticed. This practice seems to be countenanced by Mr. Marshall, who has had much opportunity of information on the subject."

In the manner of feeding down aftergrass, there is also much variety in different districts; " it has," the same author says, " been observed by a farmer in Middlesex, that the condition on which he rents his farm is that of taking out the heavy cattle at Michaelmas,

but that sheep remain till February: in this county the practice is to turn on the cattle immediately after mowing. But in the northern districts this grass, to which they have given the name of eddish, is kept till November, or even a later period for the purpose of finishing fat stock, or for the pasturage of milch cows, from which a superior quality of cheese is made; and by which time it has attained a considerable head: however, this latter practice would seem to be attended with some loss, as has been shown, from its being trodden and trampled under foot, as may be readily perceived by examining the field. In the stocking of aftergrass, Mr. Marshall found the midland graziers of opinion, that one cow to the acre on well grown aftergrass was an ample stock. Good grass-land may, however, admit something more." And instead of the pasturing of rouen, or aftergrass, by heavy cattle in the autumn, to avoid poaching the ground, particularly at a late period in that or the winter season; it has been recommended by Dr. Wilkinson, "to confine the consumption of this grass principally to the support of sheep, unless in very favourable seasons, or where the soil is uncommonly dry; in which cases, milch cows or other heavy cattle may be admitted without inconvenience."

In some places it is the practice, as has been already observed, "where there is a great scarcity of spring feed, to reserve aftergrass in the autumn for spring use. Some on the basis of experience contend that it is the most certain, and, on the whole, the best spring feed yet known. It would seem however, as has been shown, to be a wasteful practice, at least, in respect to the more forward aftergrasses. The forwardest ought certainly to be eaten without waste, before winter sets in; and the latest, that is, the shortest, be shut up for spring feed, as noticed before. An experienced agricultor, Mr. Young, it is stated, found, from repeated experiments, as suggested above, "that old aftergrass feeds sheep that give milk better than turnips, which are more adapted to the fattening of stock; and that this grass holds to a period, if wanted, when most other resources fail, the last half of April, and the first half of May—periods always of want and difficulty, where rye-grass is not sown." Mr. Marshall also assures us, that as a certain and wholesome supply of food for ewes and lambs in the early spring, the preserved pasture is to be depended upon as "the sheet anchor," in preference to turnips, cabbages, or any other species whatever of what is termed spring feed. And the same thing has been experienced by Dr. Wilkinson, who has observed, that "this food with him afforded a more nutritive and healthful quality of milk from the ewes to their tender lambs than turnips, even in their best state. But however useful aftergrass pastures may be under this management, there is evidently a great loss of food incurred by it, especially in severe winters.

It has been suggested, by Mr. Lawrence, that mowing the preserved aftergrass in the winter, and giving it to the stock in the farm-yard, might be advantageous in preventing the land from being poached, and the useful long grass from being trampled down and destroyed. But the trouble and expense of the process would perhaps in general be too great, though in particular circumstances, as where other sorts of fodder do not bear a proportion to the quantity of stock to be kept, and where sheep are conceived improper, it may afford some convenience and benefit, especially where it can be performed without injury to the ground by poaching, in the conveying away the materials which, perhaps, can seldom be the case, except where the land is very dry; in which situations there is rarely much after-grass for being converted to this use. See *Rouen*.

AFTERGRASS-*pastures*, are such as arise from the second crops of grass; or such lands as are fed down by live stock after having been mown. See *Pasture*.

AFTERMATH, a provincial term, which is also frequently employed to signify the second crop of grass, or that which springs up after the first has been cut. See *Aftergrass*.

AFTER-SWARMS, in the management of bees, are those that leave the hive some time after the first set have swarmed.

AGARIC *of the oak*, in *farriery*, a substance sometimes employed for the restraining of hæmorrhages or the bleeding of small vessels.

AGE *of animals*, the period, or length of time they have lived.

AGE *of a horse*, the length of time that he has lived. This may be ascertained by his mouth, and the examination of his teeth, till he comes eight, after which the usual marks commonly wear out. These are usually forty in all; of which twenty-four are double teeth, and, from their office, denominated grinders, four tushes, or corner teeth, and twelve fore-teeth. See *Teeth*.

The first which appear are the foal-teeth, which generally begin to shew themselves a month or two after foaling: they are twelve in number, six above and six below, and are easily distinguished from the teeth that come afterwards, by their smallness and whiteness, having some resemblance to the incisores, or fore-teeth of man.

When the colt is about two years and a half old, he commonly sheds the four middlemost of his foal-teeth, two above and two below; but sometimes it happens that none are cast till near three years old. The new teeth are readily distinguished from the foal-teeth, being much stronger, and always twice their size, and are called the nippers or gatherers, being those by which horses nip off the grass when they are feeding in the pastures, and by which, in the house, they gather their hay from the rack. When horses have got these four teeth complete, they are reckoned to be three years old.

When they are about three and a half, or in the spring before they are four years old, they cast four more of their foal-teeth, two in the upper and two in the lower jaw, one on each side the nippers or middle teeth; so that when you look into a horse's mouth, and see the two middle teeth full-grown, and none of the foal-teeth, except the common teeth, remaining, you may conclude he is four that year, about April or May. Some, indeed, are later colts, but that makes little alteration in the mouth.

The tushes appear near the same time with the four last-mentioned teeth, sometimes sooner than these,

and sometimes not till after a horse is full four years old: they are curved like the tushes of other animals, only in a young horse they have a sharp edge all round the top, and on both sides, the inner part being somewhat grooved and flatted, so as to incline to a hollow.

When a horse's tushes do not appear for some time after the foal-teeth are cast, and the new ones come in their room, it is generally owing to the foal-teeth having been pulled out before their time, by the breeders or dealers in horses, to make a colt of three years old appear like one of four, that he may be the more saleable; for when any one of the foal-teeth have been pulled out, the others soon come in their places; but the tushes having none that precede them, can never make their appearance till their proper time, which is when a horse is full four, or coming four; and therefore one of the surest marks to know a four-year old horse, is by his tushes, which are then very small, and sharp on the top and edges.

At the time when a horse comes five, or rather in the spring before he is five, the corner teeth begin to appear, and at first but just equal with the gums, being filled with flesh in the middle. The tushes are also by this time grown to a more distinct size, though not very large: they likewise continue rough and sharp on the top and edges. But the corner teeth are now most to be remarked; they differ from the middle teeth in being more fleshy on the inside, and the gums generally look rawish upon their first shooting out, whereas the others do not appear discoloured. The middle teeth arrive at their full growth in less than three weeks, but the corner teeth grow leisurely, and are seldom much above the gums till a horse is full five; they differ also from the other fore-teeth in this, that they somewhat resemble a shell; and thence are called the shell-teeth, because they environ the flesh in the middle half-way round; and as they grow, the flesh within disappears, leaving a distinct hollowness and openness on the inside. When a horse is full five, the teeth are generally about the thickness of a crown-piece above the gums. From five to five and a half, they will grow about a quarter of an inch high, or more; and when a horse is full six, they will be near half an inch, and in some large horses a full half-inch, above the gums.

The corner teeth in the upper jaw fall out before those in the under, so that the upper corner teeth are seen before those below; on the contrary, the tushes in the under gums come out before those in the upper.

When a horse is full six years old, the hollowness on the inside begins visibly to fill up, and that which was at first fleshy, grows into a brownish spot, not unlike the eye of a dried garden-bean, and continues so till he is seven; with this difference only, that the teeth are gradually more filled up, and the marks, or spots, become fainter, and of a lighter colour. At eight, the mark in most horses is quite worn out, though some retain the vestiges of it a longer time; and those who have not had a good deal of experience, may sometimes be deceived by taking a horse of nine or ten years old for one of eight. It is at this time only, when a horse is past mark, that one can easily err in knowing his age, such practices are used to make a very young horse or colt appear older than he really is, by pulling out the foal-teeth before their time, which may be discovered by feeling along the edges where the tushes grow, for they may be felt in the gums before the corner teeth are put forth; whereas, if the corner teeth come in some months before the tushes rise in the gums, we may reasonably suspect that the foal-teeth have been pulled out at three years old.

It is not necessary to mention the tricks that are used to make a false mark in a horse's mouth, by hollowing the tooth with a graver, and burning a mark with a small hot iron; because those who are acquainted with the true marks, will easily discover the cheat by the size and colour of the teeth, by the roundness and bluntness of the tushes, by the colour of the false mark, which is generally blacker, and more impressed than the true mark, and by other circumstances, which denote the advanced age of horses.

After the horse has passed his eighth year, and sometimes at seven, nothing certain can be known by the mouth. It must, however, be remembered, that some horses have but indifferent mouths when they are young, and soon lose their mark; others have their mouths good for a long time, their teeth being white, even, and regular, till they are sixteen years old and upwards, together with many other marks of freshness and vigour; but when a horse comes to be very old, it may be discovered by several indications, the constant attendants of age; such as his gums wearing away insensibly, leaving his teeth long and naked at their roots; the teeth also growing yellow, and sometimes brownish. The bars of the mouth, which in a young horse are always fleshy, and form so many distinct ridges, are, in an old horse, lean, dry, and smooth, with little or no rising. The eye-pits in a young horse are generally filled up with flesh, look plump and smooth; whereas, in an old one, they are sunk and hollow, and make him look ghastly. There are also other marks which discover a horse to be very old, as grey horses turning white, and many of them being all over flea-bitten, except their joints. This, however, happens sometimes later, and sometimes sooner, according to the variety of colour and constitution. Black horses are apt to grow grey over their eye-brows, and very often over a great part of their faces; and all horses, when very old, sink more or less in their backs; and some horses, that are naturally long-backed, grow so hollow with age, that it is scarcely possible to fit them with a saddle. Their joints also grow stiff, and their knees and hocks bend so, that they are apt to trip and stumble upon the least descent, though the road be smooth.

Mr. Taplin, however, thinks that, after the usual marks are obliterated, the only rule to judge by is the length of the teeth and the appearance of the under jaw; and that the longer the former are, and the narrower the jaw is towards its extremity, the more the horse is advanced in years.

The various progressive changes that take place in

The appearance of the teeth of horses at different ages, may be seen in plate I. figs. 1, 2, 3, 4, and 5, as given by Mr. Richard Lawrence.

AGE *of neat cattle.* The age of *cows, oxen,* and *bulls,* is known by the teeth and horns. At the end of about two years they shed their first fore-teeth, which are replaced by others, larger, but not so white; and before five years all the incisive teeth are renewed. These teeth are at first equal, long, and pretty white; but as the animals advance in years, they wear down, become unequal, and black. These animals likewise shed their horns at the end of three years; and they are replaced by other horns, which, like the second teeth, continue. The manner of the growth of these horns is not uniform, nor the shooting of them equal. The first year, that is the fourth year of the animal's age, two small pointed horns make their appearance, neatly formed, smooth, and towards the head terminated by a kind of button. The following year this button moves from the head, being impelled by a horny cylinder, which, lengthening in the same manner, is also terminated by another button, and so on: for the horns continue growing as long as the animal lives. These buttons become annular joints or rings, which are easily distinguished in the horn, and by which the age of the creature may be easily known; counting three years for the point of the horn, and one for each of the joints or rings.

The cow continues useful for more than twenty years, but the bull loses his vigour much sooner.

AGE *of sheep.* The age of these animals is known by their having, in their second year, two broad teeth; in their third year, four broad teeth; in their fourth year, six broad teeth; and in their fifth year, eight broad teeth before. After which, none can tell how old a sheep is while their teeth remain, except by their being worn down.

About the end of one year, rams, wethers, and all young sheep, lose the two fore-teeth of the lower jaw; and they are known to want the incisive teeth in the upper-jaw. At eighteen months the two teeth, joining to the former, also fall out; and at three years, being all replaced, they are even and pretty white. But as these animals advance in age, the teeth become loose, blunt, and afterwards black. The age of the ram, and all horned sheep, may also be known by their horns, which show themselves in their very first year, and often at the birth, and continue to grow a ring annually to the last period of their lives.

AGE *of goats.* The age of these animals is known by the same marks as those of sheep, as, by their teeth, and the annular rings on their horns.

AGE *of plants.* This, however difficult to ascertain, may be attempted in various ways, as from their general appearances and growth. The continuance of life is extremely different in plants, and, from this difference, they are generally divided into annual, biennial, and perennial.

The infancy of plants, like that of animals, is marked by the characters of weakness and tenderness; in the youthful state they acquire beauty and size, the vessels attract and convey their juices; the full growth is crowned with the robust fibre, and full exercise of all its functions; the fruit therefore ripens; but old age advancing, the vessels begin gradually to harden and lose their tone, they droop, the juices move no longer with equal celerity as in youth, the vital powers cease, and they die.

AGE *of trees.* The age of some trees may be determined from the number of ligneous annuli or rings. In many sorts of trees it is, however, very difficult to distinguish these, and in others utterly impossible. Some trees arrive to an astonishing age; thus the cedars of Lebanon have existed for two thousand years. But in this country the oak is the most durable.

AGRICULTURE, the science which explains the art or means of cultivating and improving the earth, so as to render it the most fertile and productive. It differs from husbandry which properly signifies only the mode of cultivating land.

This useful and important art, though less splendid than many others, appears to have attracted the notice of mankind in the earliest periods of the world; and this is not indeed very extraordinary, when it is considered that the existence and prosperity of mankind at such periods must almost have solely depended upon it. For it is obvious that in the earliest stage of society, men, as hunters, must have found from experience, that the mode of procuring subsistence by the bow or the chase was attended with infinite toil as well as hazard, and precarious in the event, therefore not by any means calculated to supply the wants, or increase the comforts of social life.

And in the pastoral state also, which may be regarded as the second step in the advancement of society, men must soon have discovered, that though more certain of subsistence and less exposed to danger and hardships, that their herds and flocks were liable to innumerable accidents, and that they might at once be reduced to all the miseries of famine. Under such circumstances and apprehensions, it was therefore natural for them to think of some means by which they might, with more certainty, procure the necessaries of life. For this purpose they would readily turn their attention towards the earth, and discover that from it might be drawn whatever could render life comfortable. Experience would likewise quickly inform them, that, by due cultivation of the soil, fruits and grain of various kinds, fit for nourishment, might be procured in abundance; but that, by neglecting this art, the natural fertility of the soil, the warmth of the sun, and the regular revolutions of the seasons, would be in a great measure unavailing.

The art of husbandry having commenced in this way, it is easy to perceive that it must have been extremely simple in these early ages, and its advances towards perfection slow and almost imperceptible.

At an early period the Chaldeans, however, are found to have carried this valuable art to a considerable degree of advancement; as they cultivated their lands with great assiduity, and enjoyed the pleasing satisfaction of receiving from their fields a plentiful harvest. The Egyptians also, who, from the fertility of their country, caused by the annual overflowings of the Nile, raised prodigious quantities of corn, and were so sensible of the blessings resulting from agriculture, that

they ascribed the invention of it to Osiris, and even carried their superstitious gratitude so far, as to worship those animals that laboured in tilling the ground.

After them the Phœnicians were also famous for their skill in agriculture; but finding themselves too much confined in their native country, by the conquests of neighbouring nations, they spread themselves through the greater part of the islands of the Mediterranean, and carried with them their knowledge in husbandry, or the art of cultivating the ground.

And the Carthaginians, following the taste of their ancestors, applied themselves assiduously to the study of agriculture. Mago, their famous general, wrote no less than twenty-eight books on that subject, which Columella tells us were translated into Latin by an express decree of the Roman senate: and Servius adds, that Virgil used these books as a model when he wrote his Georgics.

The art of sowing corn, and the tillage of land, were probably invented in Sicily; as that island was very fruitful in corn, and agriculture was there esteemed so honourable an employment, that even their kings did not disdain to practise it with their own hands.

And the Athenians, who were the first that received any tincture of politeness, taught the use of corn to the rest of the Greeks; they also taught them the manner of cultivating the ground, and preparing it for seed. The Greeks soon perceived that bread was more wholesome, and its taste more delicate and agreeable than acorns; and accordingly thanked the gods for such an unexpected and beneficial present. After this, the Athenian kings, thinking it more glorious to govern a small state wisely, than to aggrandise themselves by foreign conquests, withdrew their subjects from war, and employed them solely in the business of cultivating the earth. This constant application and attention carried agriculture to a considerable degree of advancement, and reduced it into a more perfect art.

Hesiod, who is generally thought to have been contemporary with Homer, was the first among the Greeks who wrote on this subject. He calls his poem "Weeks and Days;" because agriculture requires an exact observance of times and seasons. The other eminent Greek writers upon agriculture, are Democritus of Abdera, Socraticus, Xenophon, Tarentinus, Architas, Aristotle, and Theophrastus, from whom the art received considerable improvements; as also from Hieron, Epicharmus, Philometer, and Attalus.

The old Romans esteemed agriculture such an honourable employment, that, in the earliest times of the republic, the highest praise that could be given a man, was to say of him, that he cultivated well his own spot of ground. The most illustrious senators applied themselves to this profession; nor had they either splendor or majesty, but when they appeared in public. And their greatest generals, at their return from the toils of war, from taking of cities, and subduing of nations, were impatient till they were again employed in cultivating their lands, and thought it no disgrace to follow the plough, though they were at the same time prepared to serve the wants of the republic, attend her councils, or put themselves at the head of her armies. It must however be allowed, that when the Romans became tainted with the luxury of Asia, they gradually lost the noble simplicity of their ancestors, and employed their slaves in the severer labours of a country life. But though they did not themselves hold the plough, yet even men of consular dignity looked upon it as a reward for their public services, when they obtained leave to retire into the country, and were equally respected when overlooking their farms, as when seated in a chair of magistracy. M. Cato, the censor, that illustrious Roman general, orator, politician, and lawyer, after having governed provinces, and subdued nations, did not think it below his station to write a large treatise on agriculture. This work, according to Servius, was dedicated to his own son, and was the first Latin treatise on that subject. It is said to have been handed down to us in all its purity, and in the same manner that Cato wrote it. Varro composed a treatise on the same subject, but on a more regular plan. This work is embellished with all the Greek and Latin erudition of that learned author.—Agriculture also received great improvements from the two Sasernaes, and likewise from Scorfa, Tremellius, and M. Terentius. Virgil has adorned it with the language of the muses, and given it majesty by his verse. He has finely embellished those precepts of husbandry which were left by Hesiod and Mago.

And Columella, who flourished in the reign of the emperor Claudius, wrote twelve books on husbandry, which contain a variety of interesting facts and observations. He was a native of Bœtica in Spain, and had devoted much time to the study of rural affairs, and the economy of farms.

From this period till the reign of Constantine IV. the art of husbandry appears to have been in a declining state, when that wise emperor caused a large collection of the most useful precepts relating to it to be extracted from the best writers, and published under the title of Geoponics.—Some say he made this collection with his own hand. Nor is this at all improbable, as it is well known that, after he had conquered the Saracens and Arabians, he not only practised, but studied the arts of peace, fixing his chief attention on the advancement of agriculture.

But from the time of Constantine IV. till about the year 1478, it laid in a kind of dormant and neglected state, when Crescenzio, an Italian, revived it by publishing an excellent performance on the subject at Florence. He was soon followed by several of his countrymen, among whom Tatti, Stefano, Augustino Gallo, Sansovino, Lauro, and Tarello, deserve to be particularly noticed.

In the mean time, in our own country, Fitz-Herbert, judge of the Common Pleas, shone with unrivalled lustre in the practical parts of husbandry. He published two treatises on this subject; the first, which was entitled "The Book of Husbandry," appeared in 1534, and the second, called "The Book of Surveying and Improvements," in 1539. As the observations and instructions contained in these works were the result of much practical experience, they excited great attention to the subject, and soon raised a spirit of emulation in his countrymen, in consequence of which, many treatises of the same kind successively

appeared; but time has deprived us of many of those writings, or at least they are become so very scarce, as only to be found in the libraries of the curious.

About the year 1600, France made considerable efforts to revive husbandry, as appears from several large works, particularly *Les Moyèns de devenir riche*, and the *Cosmopolite*, by Barnard de Palissy, an indigent porter; *Le Théatre d'Agriculture*, by De Serres; *L'Agriculture, et Maison Rustique*, by Messrs. Etienne and Liebault; and more lately the *Journal D'Agriculture*, by M. L'Abbé Rosier, as well as several other valuable works.

The Flemings, about the same period, were more attentive to the practice of husbandry, than the publishing of books on the subject; their intention being doubtless to carry on a private lucrative trade, without instructing their neighbours in their modes of cultivation: hence it happened, that whoever was desirous of copying their method of agriculture, was obliged to travel into their country, and make his remarks upon the spot. Their principal idea of husbandry, which was indeed just enough, consisted in making a farm resemble a garden as much as possible. The adoption of such an excellent principle at first setting out, led them of course to undertake the culture of small estates only, which they kept perfectly free from weeds, by continually hoeing and turning the ground, and rendered it rich and productive, by manuring it plentifully, and in the most judicious manner.

And when by this means they had brought the soil to a proper degree of cleanliness, health, and sweetness, they ventured chiefly upon the culture of the more delicate grasses, as the surest mode of acquiring wealth in husbandry upon a small estate, without the expense of keeping many draught-horses or servants. And a few years experience was abundantly sufficient to convince them, that ten acres of the best vegetables for feeding cattle, properly cultivated, would maintain a larger stock of grazing animals than forty acres of common farm grass. They also found that the best vegetables for this purpose were lucern, saintfoin, trefoil of most denominations, sweet fenugreek, buck and cow-wheat, field-turnips, and spurrey. The political secret of their husbandry, therefore, consisted in letting farms on improvement. They also discovered eight or ten new sorts of manure. They were the first among the moderns who ploughed-in living or green crops, for the purpose of fertilizing the earth, and who confined their sheep, at night, in large sheds built on purpose, whose floors were covered with sand or virgin earth, &c. which the shepherd carted away every morning to the compost dunghill. This useful and judicious practice has, since that period, been too little attended to by the practical farmer.

Our fatal domestic wars, during the reign of Charles I. changed the instruments of husbandry into martial weapons; but after the death of that unfortunate monarch, artful and avaricious men crept into the confiscated estates of the nobility, gentry, and clergy; and as many of these new encroachers had risen from the plough, so they returned with pleasure to their old profession, being chiefly animated by the love of gain. Plattes, Hartlib, Blythe, and others, seized this favourable disposition of the common people, and encouraged it by writings, which have since had few to equal them; nor was Cromwell wanting in lending his assistance in this important business.

Sir Hugh Platt was one of the most ingenious husbandmen of the age in which he lived; and so great was his modesty, that all his works, except his Paradise of Flora, seem to be posthumous. He held a correspondence with all the lovers and promoters of agriculture and gardening in England; and such was the justice and honesty of his temper, that he always named the author of every discovery that was communicated to him. Perhaps no man, in any period in the history of the art, discovered, or, at least, brought into use, so many new sorts of manure, as his account of the compost and covered dunghill, and his observations on the fertilizing qualities contained in salt, street-dirt, and the sullage of streets in great cities, clay, fuller's earth, moorish-earth, dung-hills made in layers, fern, hair, burned vegetables, malt-dust, willow-tree earth, soap-boiler's ashes, marle, and broken pilchards, sufficiently demonstrate.

Gabriel Plattes may likewise be esteemed an original genius in promoting the improvement of agriculture. He began his valuable observations in the time of queen Elizabeth, and continued them through the reigns of James I. Charles I. and during the first three or four years of the commonwealth. But notwithstanding the great merit displayed in his writings, the public shamefully suffered him to starve and perish in the streets of London, not having a shirt upon his back when he died.

Samuel Hartlib, a celebrated writer on husbandry, was highly beloved and esteemed by Milton, and other ingenious men of that time. In his preface to a work commonly called his Legacy, first published in the year 1650, he laments that no public director of husbandry was established in England by authority; and that we had not adopted the Flemish method of letting farms upon improvement. These observations of Hartlib procured him a pension of one hundred pounds a year from Cromwell, who was a great favourer of agricultural improvement; and the writer afterwards, the better to fulfil the intention of his benefactor, procured Dr. Beati's excellent annotations on the Legacy, with several other valuable pieces from his numerous correspondents.

The period in which this author flourished appears to have been an æra when English husbandry rose to great perfection; for the preceding wars had made the country gentry poor, and, in consequence, more industrious. They found the cultivation of their own lands to be the most profitable post they could occupy. But a few years afterwards, when the Restoration took place, all this industry and knowledge became useless, from the new system that was acted upon, and was exchanged for heedlessness and dissipation; from which husbandry passed almost entirely into the hands of common farmers.

But the famous work usually attributed to Hartlib, and called the Legacy, was only drawn up at his request; and, after passing through his correction and revision, published by him. The real author of the treatise, which consists of one general answer to the following question: "What are the actual defects

and omissions, as also the possible improvements, in English husbandry?" was a person of the name of R. Child, who seems to have been acquainted with many ingenious improvers of agriculture at that period.

Several other pieces succeeded the publication of the Legacy, which greatly improved and augmented the means of cultivation.

And Grew, by the publication of the Anatomy of Plants, and showing, in some measure, the economy of the vegetable system, contributed to enlarge the views and extend the inquiries concerning the nature of vegetation and the food of plants.

But a principal writer who inspired his countrymen with a desire of reviving the study of agriculture after the Restoration, was Evelyn; who, being followed by Ducket, Ray, Dugdale, and several other authors, the art of cultivation was greatly recovered, and some new improvements introduced. And the establishment of the Royal Society, which took place a few years afterwards, contributed still more fully to the advancement of it, by serving as a focus for the collecting and recording valuable materials on the nature of vegetation and the principles of agriculture, as well as other subjects. About the year 1706, many additions and improvements were made in this useful art. Mortimer, by his explanations of various practical modes of management; Bradley, by reducing the facts on vegetation into a more systematic order; Hales, by his valuable statical experiments and investigations; and Miller, by the publication of his dictionary and other works, contributed very materially to this purpose. But agriculture is probably still more indebted to the exertions of Tull, notwithstanding the evident futility of many of his positions, as by showing the utility and importance of drilling, and frequently hoeing, pulverizing, or stirring the ground about the roots of plants, and thereby keeping them clean and free from weeds, farmers have been induced to adopt more clean and sure methods of cultivating their arable lands. The introduction of this system of management, therefore, in some degree, forms an æra in the history of English husbandry.

In Ireland too, about the middle of the last century, the art of husbandry began to make considerable progress; that country having had very strong prejudices in behalf of a very wretched method of agriculture, until about that period, when Blythe opened the eyes of the people by his incomparable writings: since which a spirit of improvement has, more or less, been promoted and carried on with zeal and constancy by the nobility, clergy, and gentry of the kingdom. In proof of which it will be sufficient to observe, that a society for the encouragement of agriculture has been established, the transactions of which are highly respectable and important. In many respects, however, Irish husbandry is still much behind that of Britain, and must, most probably, continue so until the practice of leasing farms become much more general.

At the conclusion of the peace of Aix-la-Chapelle, almost all the nations of Europe, by a sort of tacit consent, applied themselves to the study and practice of agriculture; and continued to do so, more or less, amidst the universal confusion that soon succeeded. The French found, by repeated experience, that they could never maintain a long war, or procure a tolerable peace, without they raised corn enough to support themselves in such a manner as that they should not be obliged to submit to harsh terms on the one hand, or perish by famine on the other. Their king, therefore, thought proper to give public encouragement to agriculture, and was even present at the making of several experiments. The great and rich, of various ranks and stations, followed this noble example, and the ladies even put in for their share of fame in the laudable undertaing. Even during the hurry and distresses of the last war, some attention was paid to agriculture. Prize questions were then proposed annually in rural academies, particularly at the two academies of Lyons and Bordeaux. And many alterations were made by the society for improving agriculture in Britany. And after the conclusion of peace, matters were carried on with greater vigour. The university of Amiens has made various proposals to the public for the advancement of husbandry; while the marquis de Tourbilly, a writer proceeding chiefly on practical experience, undertook the principal direction of the Georgical Society, established at Tours, and the Society of Rouen was also usefully employed on the same subject.

It may be added, that many societies were afterwards established by royal approbation, for the promoting of agriculture, and rendering the knowledge of it more general and extended.

The convulsive shock of the revolution, which has overturned many useful establishments, and retarded the advancement of many improvements, has not by any means prevented the progress of agriculture, as is evinced by the appearance of numerous papers on the subject, in the transactions of different societies. Indeed, it would seem probable, that from the crippled state of commerce, unusual attention has been paid to the art of cultivation.

The science of agriculture is publicly taught both in the Swedish, Danish, and German universities.

Nor has Italy been inactive. The Neapolitans of the present age have condescended to return back to the first rudiments of revived husbandry, and begun to study afresh the agriculture of Crescenzio, first published in the year 1478. The people of Bergamo have pursued the same track, and given the world a new edition of the *Ricardo d'Agricultura di Tarello*, which was originally published at Mantua in 1577.

The duchy of Tuscany has imbibed the same spirit. A private gentleman left his whole fortune to endow an academy of agriculture. Even Ferrara, a small territory in the papal dominions, has contributed its just contingent, and made some laudable attempts in this art.

Animated with a desire that the people under his government should excel in husbandry, his Sardinian majesty ~~sent his~~ subjects to learn the practice of foreign countries, and made several attempts to establish a better method of agriculture among his people.

In Poland, where a natural fertility of soil seems to dispense with the necessity of calling in improvements, M. de Bieleuski, formerly grand-marshal of the crown, made abundance of successful attempts to introduce the

new husbandry among his countrymen, and procured the best instruments for that purpose from France and other parts of Europe.

The Hollanders seem to have given the least attention to agriculture, if we except one single collateral instance, namely, the draining of fens and morasses; and even that has probably proceeded more from the motive of self-preservation, than any particular turn towards husbandry.

In the year 1759, a society established itself at Berne, in Switzerland, for the advancement of agriculture and rural œconomy. That society consisted of many ingenious private persons, and also of some of great weight and influence in the republic; most of them men of a true cast for the improvement of husbandry, being enabled to join the practice with the theory. They have since published several useful papers on different matters connected with the subject.

We must not omit to mention here, that Linnæus and his disciples performed much in the north of Europe, particularly in discovering new, profitable, and well-tasted food for cattle. At the same time Sweden has bestowed successful labours on a soil, which was before looked upon as cold, barren, and incapable of melioration; of this the memoirs published at Stockholm will be a lasting monument.

Denmark, as well as many courts in Germany, have followed a similar example. His Danish majesty encourages, in particular, the woollen manufacture; and the late king sent three persons into Arabia Felix, to make remarks, and bring over such plants and trees as might be useful in husbandry, building, &c.

Nor has the duchy of Wirtemberg, a country by no means particularly unfavourable to corn and pasturage, failed to contribute its assistances towards the improvement of agriculture, having some time ago communicated to the public its œconomical labours from the press at Stutgard.

The learned of Leipsic and Hanover have not been solely inattentive to the art of supporting the human kind; for, amidst the rage and devastations of war, the *Journal d'Agriculture*, printed at Leipsic, and the *Recueils d'Hanovre*, printed at that city, have been brought out.

Even Spain, naturally inactive on these occasions, in spite of all the prejudices of a bigotted religion, invited Linnæus, with the offer of a large pension, to superintend a college, founded for the sake of making new inquiries into the history of nature, and the art of agriculture.

But it is probably in our own country that agriculture has been the most attended to, and received the greatest improvement; and there is reason to hope, from the excellent example set by his majesty, and the spirit that now animates a great number of the nobility and gentry, that this useful art may, in a few years, be carried to a much greater degree of perfection than it has yet reached in any age or nation. In this view, the respectable society established at London for the encouragement of arts have already done much, and there is reason to hope they may do more. A vast variety of different machines for facilitating the practice of agriculture have been invented, and presented to the public, in consequence of the large premiums and bounties which have been offered. The institutions of societies in different parts of the kingdom, for the improvement of agriculture, and the endowment of a professorship at Edinburgh, for the same laudable purpose, cannot but promote the study, and enlarge the boundaries of the science.

About the year 1767, Mr. Arthur Young commenced his valuable and well-directed labours, which, by attracting the attention of practical agriculturists to those improved means of cultivation that are made use of in parts of the country very remote from each other, and shewing the great utility of experimental inquiries on the subject, and by promoting and diffusing a taste for the science, from the easy and popular language of his writings, have rendered the most essential advantages to the agriculture of the nation.

The late Doctor George Fordyce likewise contributed in no small degree to the advancement of the science, by the publication of his Elements of Agriculture and Vegetation, a work in which the chemical principles of the various substances that enter into the composition of soils and manures, are well explained.

Mr. Marshall, too, by registering the local customs and practices of different districts, has afforded considerable service to the farmer, by bringing him acquainted with a variety of modes of rural management, which he could not otherwise have known.

Doctor Anderson, by his useful essays and observations on various departments or branches of rural œconomy, as well as vegetation, has likewise very materially contributed to the same end. And Mr. Bakewell, by bringing the flock-farmer better acquainted with the nature and principles of breeding and rearing different kinds of improved domestic animals, as well as many other useful practices, has been of the most essential advantage to the grazing department of the art.

The explanations of the nature and principles of the art of draining different sorts of land, as laid down by Mr. Elkington and Mr. Johnstone, have likewise contributed in a very high degree to the improvement of husbandry.

But neither the endeavours of provincial societies, nor the exertions of individuals, with whatever zeal and attention they may be conducted, or however well they may be directed, are sufficient to extend the knowledge of husbandry to that degree which is necessary for its complete and radical improvement. This could only be fully accomplished by the powerful influence and expensive exertions of a national establishment instituted for the purpose. Such an institution has at last been brought forward and established by the intelligent and persevering efforts of Sir John Sinclair, to the honour of the country, the age, and the individual who suggested it. The institution of a Board of Agriculture and Internal Improvement has already contributed materially to the extension and advancement of the knowledge of rural affairs. The state of the art in the greatest part of the kingdom has been ascertained, a great variety of new and interesting facts and practices have been brought to view, and improvements in the instrumental and other

departments suggested in the different publications which it has laid before the public. See *Board of Agriculture.*

In addition to this great source of improvement, the science of agriculture has derived essential advantage from the judicious application of the principles of other sciences. In this respect the discoveries in modern chemistry and vegetation have been particularly important, as is evident from the works of Tillet and Hassenfratz, on the continent; and of Priestley, Anderson, Kirwan, Dundonald, Darwin, Dickson, and many others, in our own country.

AGRIMONY, the name of a troublesome perennial plant, of the weed-kind, sometimes found in pasture-grounds, of which there are three species. It has generally a single, round, rough stalk, with leaves placed alternately upon it, which are winged with smaller leaves placed between the larger pairs. The yellow flowers grow alternately along the stalk, in a long row, after the manner of a spike, and are succeeded by rough seeds. The propagation of all the sorts is both by seeds and roots.

AGROSTIS, a genus of grasses, of which there are several species, but few that are serviceable in an agricultural point of view. It is the bent-grass.

Agrostis *Alba*, the white bent-grass, which is perennial, and flowers in July.

Agrostis *Canina*, the brown bent-grass, or tufted leaved. It is perennial, and flowers in July. Mr. Curtis has termed it *fascicularis*, as the stalks in autumn produce leaves in tufts.

Agrostis *Capillaris*, fine bent-grass. This, Mr. Curtis says, is very common on all dry heaths, in pastures, and road-sides, distinguished by its very finely divaricated panicle. The principle objection to this tribe of plants is the lateness of their flowering, scarcely any of them coming into bloom till July: if any of them deserve culture, it is this species, as it is one of the earliest, and has fine and productive foliage. It is the grass which, in many parts of the kingdom, forms the turf of our extensive pastures, downs, and sheep-walks; whole acres are frequently observed covered nearly with it alone: for grass-plats and lawns, it would seem to be the best of all the English species, being of ready growth, bearing the scythe well, producing fine foliage, and resisting drought better than most; the foliage of some of the species of this genus of grasses is, however, still finer, and would probably succeed better for the same purposes in moist soils and situations. See *Grasses.*

Agrostis *Cornucopia*, a grass to which this title has been given, and which in common language is termed American bent-grass. It has but been introduced into England within these few years. It was first introduced into Georgia, in America, where it still continues to flourish; and is found better than any other grass for running amongst the rocks, and standing drought; but its chief excellence is said to be, that not only cattle, horses, and sheep fatten upon it, but that every species of poultry are fond of it. It is greatly favourable for making of grass-plats, being of a fine texture, and a beautiful verdure in this country throughout the year. Mr. Fraser, of Chelsea, made the following experiments with it: A few seeds sown Nov. 20, 1788, continued dormant all the winter. The plants made their appearance in the beginning of March: flowered early in September, when they measured from three to four feet. Each root produced one hundred stems: each stem sending forth branches, some from four to six, others as far as ten or twelve, bearing panicles for seed; each panicle from twelve to eighteen inches long. This shows the multiplication to be infinite. A small quantity was sown March 15, 1789. Seedlings transplanted, by dividing the roots on the 22d of May; began unexpectedly to flower in September, and completed their flowers nearly as early as those sown in the November preceding. On the 9th of September, measured two feet five inches. Part of the bed cut close to the ground on the 15th of August; measured, on the 9th of September, from twelve to sixteen inches; and on the 10th of October twenty-two inches. The swarth much thicker than what had not been cut down. It then began to flower, from 100 to 200 panicles on each root. Having cleaned a cask of seed accidentally about the middle of April following, in a little hard gravelly court, about a month afterwards, to his surprise, he found the grass coming up very thick; and it has continued in as flourishing a state as any he has sown in the garden.

Apprehending that the success in the gravelly court might be chiefly owing to the seeds not being buried in the ground, on the 15th of May he took a four-inch board, and laid out with it four drills twenty feet long, pressing down the board in the drills so as to render the surface smooth and hard. He then took a gill of the seed, and mixed it with a peck of mould and soot, and sowed it in the drills, without any other covering. A very fine crop was the consequence. On the 10th of October, it measured twenty-two inches high, and contained plants sufficient to occupy half an acre. Same day sowed four rows in the manner of mustard and cresses, about half an inch deep in the ground, covering it with mould. No plants came up.

From these experiments he concludes, that the proper management of this grass is, that the ground should be in extremely fine tilth, well cleaned, harrowed, and rolled with a heavy roller, before the seed is sown. At the time of sowing, a quart of seed should be mixed with a bushel of light earth and soot.

On the 10th of October, he cut down a patch of grass, which had been sown on the fourth of June. It measured twenty-seven inches. The part so cut down measured, on the first of November, twenty days after it was cut, nine-inches. One seedling plant was divided the 22d of May into 200, and which were transplanted out and cut down the 15th of August, measuring then twenty inches: one of these plants so transplanted was taken up in the presence of a gentleman on the 10th of October, and divided into 201 plants, and planted into a bed; notwithstanding so late in the year, they are flourishing. The above-mentioned seedling has, at this rate, multiplied itself into 4000 plants in five months. It might have been multiplied into double or treble this number, by dividing the joints, as it propagates from them as well as by the root.

The greatest part of the above experiments have

been made in a garden, for want of a field to try them in: this, however, is equally conclusive as if it had been in a field, as the garden is a poor gravelly soil.

Nothing now remains fully to ascertain the great importance of this discovery, but to observe the effects of the winter on it in this country. And as it is now found to be a native of Canada, there can be little doubt that it will be injured by the frosts in this climate, as the roots strike very deep in the ground; a circumstance which cannot fail to protect it during the severest frost that can happen in winter, as well as the greatest drought in summer.

In Feb. 1790, we have a farther account of it from the same author: he found it look more like wheat in the month of May, than grass; some of the plants, sown early in March, measured three feet; one root produced a hundred stems, from each of which branches six or seven panicles for seed, some of which panicles measure upwards of eighteen inches long. Part of the above he transplanted the 22d of May, and cut close to the ground the 15th of August, it then measured two feet five inches; that part which is cut is now twenty inches high; and what appears to him extraordinary, was a show of about two hundred panicles on each root, and its forming a thick swarth, and a much finer blade than that which was not cut. One of the said roots was taken up in the presence of Mr. Hudson, author of the *Flora Anglica*, which was divided into two hundred and one; and was transplanted six inches apart, in order to observe what progress it might make in the course of the winter.

Agrostis *Litoralis*, the sea-side bent-grass, which is a sort found in salt-marshes and other situations on the borders of the sea. It is a perennial, flowering in August, and said to be common near Cley, in the county of Norfolk.

Agrostis *Minima*, this is what has been usually termed the smallest bent-grass; but which Mr. Curtis considers as no agrostis, but a distinct genus. It is found the most abundantly in sandy pastures. It is annual, flowering in March, and the following month. It is pretty common on the south-west part of Anglesea in Wales, near the borders of the sea.

Agrostis *Palustris*, this is the Marsh bent-grass, is found the most abundant in wet meadows and marshes, where it frequently grows to a great height; its foliage, like that which has been first described, is fine, but it is liable to the objection of lateness of flowering. In this, according to Curtis, the branches of the panicle, after blowing, remain spread out, and the seed is heavy.

Agrostis *Setacea*, the bristly bent-grass, or what Mr. Curtis terms sheep's-fescue leaved. It is found in pretty abundance in the western parts of the island, as well as on the borders of the coast, in the neighbourhood of Weymouth, being perennial, and flowering in July and the following month.

Agrostis *Spica-venti*, the silky, or bearded bent-grass, which is annual, and flowers in June and the following month.

Agrostis *Stolonifera*, the creeping bent-grass, which is perennial, and flowers in July and the following month.

Agrostis *Stricta*, the upright bent-grass, which is perennial, and in which the whorls of the panicle, when blowing, are horizontal, and before this contract into a kind of spike, and afterwards the whole turns red. It is found pretty common in some parts of Scotland.

AIR, the thin medium in which terrestrial animals move and breathe, and which surrounds the earth to a great height. It is possessed of weight or gravity, and capable of compression; but not condensible in the heat of the atmosphere without combination: without it, animals and vegetables could not live, nor fire be maintained, or heat generated. But though the atmosphere be the vast laboratory in which nature performs immense operations, solutions, precipitations, and combinations, and the grand receiver in which all the attenuated and volatilised productions of terrestrial bodies are lodged, mingled, agitated, combined and separated, still the air is the same in respect to its qualities, being decidedly characterised by the two properties of supporting respiration and combustion. This is sufficiently evident, from combustible bodies not being burnt without the contact of atmospheric air, as in vacuo this process does not take place. From respiration and combustion not continuing beyond a certain length of time, in a given quantity of atmospheric air, it is likewise plain, that only a part of the air that surrounds us is proper for the support of animal life and combustion, the other being improper for these purposes. Thus it is obvious, that atmospheric air is a compound of two different airs, the one supporting respiration and combustion, and thence denominated vital air, pure air, or oxygen; the other injurious in these respects, but necessary in a certain proportion, in order to modify the too powerful action of oxygen in the respiration of animals; this is termed, from its properties, azote, or phlogisticated air. One hundred parts of common or atmospheric air contain twenty-seven of the oxygenous or pure air, and seventy-two of the azotic or nitrogen air, the rest being carbonic acid air.

The common or atmospheric air also contains a proportion of fixed air, or what is now termed carbonic acid gas, from carbonaceous matter, or charcoal forming one of its constituent parts.

The vital air or oxygen, by combining with ignited inflammable bodies, produces different gasses and new compounds. The common air may likewise contain other airs or gasses; such as light inflammable air, or hydrogenous gas; dense inflammable air, or carbonated hydrogenous gas; vitriolic acid air, or sulphureous gas; sulphurated inflammable air, or sulphurated hydrogenous gas; nitrous air, or nitrous gas; muriatic air, or muriatic gas, &c. See *Gas, and these different airs.*

Long before the discoveries in modern chemistry had ascertained the constituent principles of common air, it had been remarked to be a principal agent in the vegetation of plants, by Mr. Ray, in the Philosophical Transactions, who found that lettuce-seed, which was sown in the glass receiver of the air-pump,

exhausted, and cleared from all air, grew not at all in eight days time; whereas, some of the same seed, which was sown at the same time in the open air, has risen to the height of an inch and an half in that time; but on the air being let into the exhausted receiver, the seed grew up to the height of two or three inches in the space of one week. And another proof of the utility of air in vegetation is the sedum, which pushes out roots without earth or water, and lives for several months; some sort of aloes, if hung up in a room entirely secured from frosts, will also remain fresh for some years, though they sensibly lose in their weight.

The air operates also within the bowels of the earth, and, from the changes which it undergoes, and the new combinations that are formed in consequence of them, contributes greatly to promote the growth of plants.

Air was considered by the learned Dr. Hales, to be a fine elastic fluid, with particles of very different natures floating in it, whereby it was admirably fitted by the great Author of Nature, to be the breath or life of vegetables, as well as animals, without which they can no more live or thrive than animals can. And as a proof of the great quantities of air in vegetables, he refers to the third chapter of his excellent Treatise on Vegetable Statics; where, he says, in the experiments on vines, that a great quantity of air was visible, which was continually ascending through the sap into the tubes: which manifestly shows what plenty of it is taken in by vegetables, and is perspired off with the sap through the leaves.

He likewise adds several experiments made on an apple-branch, apricot-branch, birch, and other plants, to prove the same thing.

Dr. Grew also observed, that the pores are so large in the trunks of some plants, as in the better sort of thick walking canes, that they are visible to a good eye without a glass; but, with a glass, the cane seems as if stuck at top full of holes with great pins, so large as very well to resemble the pores of the skin in the ends of the fingers and ball of the hand. In the leaves of pines, he likewise observes, that, by means of a glass, they make a very elegant show, standing almost exactly in rank and file, through the length of the leaves. Whence he thinks it may be probable, that the air enters plants, not only with the principal food or nourishment by the roots, but also through the surface of their trunks and leaves, especially at night, when they are changed from a perspiring to a strongly imbibing state.

Dr. Hales has remarked, however, that, in all the experiments that he tried for this purpose, he found that the air entered very slowly at the bark of young shoots and branches, but much more freely through old bark; and that in different kinds of trees, it had different degrees, or more or less freedom of entrance. And likewise, that there is a portion of air, both in an elastic and unelastic state, mixed with the earth, as he found by several experiments which are detailed in his work.

Mr. Boyle, also, in making experiments on air, among other discoveries, found, that a good quantity of it was produceable from vegetables, by putting grapes, plums, gooseberries, peas, and several other sorts of fruits and grain, into exhausted and unexhausted receivers, where they continued for several days emitting great quantities of air.

These led the ingenious Dr. Hales to further researches on the subject, in order to discover what proportion of air he could obtain from the vegetables in which it was lodged and incorporated; and he concluded, that air is abundant in vegetable substances, and bears a considerable part in them: and, that if all parts of matter were only endowed with a strongly attracting power, all nature would then become one inactive cohering mass.

Some substances are found to contain much larger proportions of airs, and to yield or part with them with much greater ease and facility than others; a circumstance which has much influence in the practice of agriculture.

Later experiments have, however, in consequence of the knowledge that has been acquired of the constituent principles of the air, from the ingenious inquiries of Black, Cavendish, Priestley, Darwin, and many others in our own country; and the exertions of Lavoisier, Berthollet, Morueau, Adot, Hassenfratz, Monge, Chaptal, and various other chemical philosophers on the continent; brought us more fully acquainted with the causes of the numerous beneficial effects that are daily produced on vegetation by the agency of this fluid.

It has been found that both of the principles which constitute atmospheric air, are highly useful in the œconomy of plants; and that, by their different combinations with other matters, they contribute greatly to vegetation.

Mr. Young, at an early period, turned his attention to the importance of air in agriculture, and found, by a variety of interesting experiments, that it might be extracted from some soils in much greater abundance than others, which circumstance induced him to conclude that their goodness in a great measure depended on the quantity of different airs which they contained. Extending his inquiries to different sorts of manures and various substances from which they may be composed; he likewise discovered, by numerous trials, that their powers of increasing the fertility of ground were somewhat proportioned to the quantities of the airs which could be extracted from them.

It has been seen that the vegetative process of grain seed, and other vegetables, is greatly promoted by the free and easy access of the air, which strongly enforces the necessity of pulverising, and reducing the soil to a state of considerable fineness, before they are introduced into it.

Seeds and plants can grow in the moisture of the air, and in water, without the intervention of earth; but neither of these are sufficient for the purpose without the free admission of air. Many plants of the succulent kind retain their vegetative quality a considerable length of time, merely by the agency of the air, and some emit roots from the branches that are cut from them on being exposed to the air, without the assistance of either earth or water. The *Sedum* and *Sempervivum* afford examples of this kind. Air is likewise necessary, in order to preserve the vegetative faculty of grain and seeds, while they are

kept for the purpose of sowing, as is evinced by inclosing them in vessels close-stopped and prevented from receiving air; for, under such circumstances, their germinating property is found to be either completely destroyed or greatly impaired. On this account many sorts of grain and seeds may be considerably injured and retarded in their vegetation, by being deposited too deep in the ground. There are, however, many seeds which are able to retain this faculty, though for a long time buried deep in the soil, as is evident from their readily coming up, on the earth being turned up to a great depth.

A free exposure to the action of the air is also requisite for the vigorous growth of trees, grasses, and other plants of the same kind, as is shewn by their becoming weak and puny in confined or shaded situations. Fruit also is much injured by the trees being crowded, or having too great a quantity of wood in them.

Air being thus equally necessary to the vegetation and growth of plants, as to the life of animals, by a most beautiful arrangement in the œconomy of nature, says the earl of Dundonald, the different processes of animal and vegetable respiration are made mutually to assist each other. The particular gas or air thrown off by the respiration of the one contributing to the existence of the other. In respect to the application and use of air in the management of horses and other animals, see *Stable* and *Horse*.

AIRA, a genus of grasses, of which there are many species, but few of which are capable of being cultivated to advantage as field-grasses, on account of their aquatic nature. The hair-grass.

Aira *Aquatica*, the water hair-grass, which is a very sweet grass, abounding with sugar, and is excellent for butter and cheese; but cannot be cultivated in the field, as it must have water to grow in. It is found in ponds and water-grips in several places, and in the ditches on Glastonbury Moor, in great abundance. This is the grass which contributes chiefly to the sweetness of Cottenham cheese, and the fineness of Cambridge butter. It is perennial, and flowers in May, and the following month.

Aira *Cæspitosa*, this is the turfy hair-grass, which is a stately elegant grass; but so rough and harsh that animals cannot be made to eat it. It grows abundantly in woods, in many parts of the kingdom, and from five to six feet in height. It is also perennial, and flowers in June and July.

Aira *Canescens*, the gray hair-grass, which is an excellent sheep-grass, and but little inferior to the sheep's-fescue; but as it affects sand and sea air, it is difficult to be raised. This is the predominant grass of Maden Downs, and is met with on those about Exeter and Bridport. It is not improbable but that this grass might be cultivated to advantage in the field on the poorer sorts of soil. It is perennial, and flowers in July, being found on the coasts in Norfolk and Suffolk.

Aira *Cristata*, the crested hair-grass, which is but a middling sort of grass, its hairiness showing its coarseness; but its being seldom found in blossom, even where it abounds, denotes that it is not refused. It was observed on Gog-Magog Hills, in Cambridgeshire, in the year 1775, by Mr. Sole, on a piece of ground detached for mowing, in which it was predominant, and in full bloom; but he could find none of it without the hedge. He therefore concludes it to be a passable grass for sheep and deer. It is also found on Claverton Down, and is perennial, flowering in July and the succeeding month.

Aira *Cœrulea*, the blue hair-grass, which is a fen grass, of some account in the Isle of Ely, where they make besoms of it, called *bent-besoms*; but it is not by any means fit for cultivation in the field, being so hard and sour that nothing eats it. This grass is found on Glastonbury Moor in abundance, and it sometimes grows to six feet or more in height.

Aira *Flexuosa*, the purple hair-grass, which has pretensions to merit for culture in the field, as producing sweet mutton, it being a principal grass on Banstead-Down, Mendip, &c. and is equally fine and nutritive with the sheep's-fescue; but yields to that in not being so productive, and in being difficult to cultivate. It is perennial, and flowers in July.

Aira *Montana*, the mountain hair-grass, which is esteemed a good venison and mutton-grass; but, like the foregoing, impatient of cultivation. It is perennial, and flowers in July.

AIRING, in the management of horses, implies the utility of exercising them in the open air, which is of the greatest advantage to them when performed with moderation, and according to the circumstances or state in which they are in respect to their health and the nature of their keep. By this means their legs are prevented from swelling, their stomachs improved, and their wind rendered more free and perfect. See *Exercise*.

AIR-SHAFTS, in *mining*, signify holes or shafts driven down from the surface of the ground perpendicularly, to meet the adits and supply fresh air. The necessity of these mostly arises from damps and want of pure air, in cases where the adits are of very considerable length. The difficulty and expense of forming these shafts are frequently very great.

AIR-VESSELS, of *vegetables*, are certain horizontal vessels of large diameter, that pass through the bark of trees to the alburnum, which Dr. Darwin thinks probably contain air, as they are apparently empty, he believes, in the living vegetable: for the bark of trees consists of longitudinal fibres, which are joined together, and appear to inosculate at certain distances, and recede from each other between those distances like the meshes of a net, in which spaces several horizontal apertures are seen to penetrate through the bark to the alburnum, according to Malpighi, who has given a figure of them. Very fine horizontal perforations through the bark of trees are also mentioned by Duhamel, which he believes to be perspiratory or excretory organs; but adds, that there are others of much larger diameter, some round and some oval, and which, in the birch-tree, stand prominent, and pierce the cuticle or exterior bark. These vessels probably contain air during the living state of the tree, as they pierce the external bark, which frequently consists of many doubles, like a roll of linen cloth; as a new cuticle is annually produced beneath the old one, like a new scarf-skin beneath a

blister in animal bodies; and the old one sometimes continues, and sometimes peels off like the cuticle of a serpent, as is seen on the trunks of many cherry-trees and birches. These vessels, when contracted in dry timber, appear like horizontal insertions in many planed boards, in which the spiral absorbent vessels become by their contraction the longitudinal fibres, as appears in the figure of a walking-cane given by Dr. Grew. These horizontal vessels Dr. Darwin supposes to contain air, inclosed in a thin moist membrane, which may serve the purpose of oxygenating the fluid in the extremities of some fine arteries of the embryon buds, in the same manner as the air at the broad end of the egg is believed to oxygenate the fluids in the terminations of the placental vessels of the embryon chick.

ALABASTER, a kind of stone, the basis of which is calcareous earth. It varies from marble, in having the sulphuric acid in combination with this earth instead of the carbonic, on which account it does not effervesce when acids are poured upon it. At the temperature of about sixty degrees, it is soluble in five hundred times its weight of water. See *Sulphat of Lime and Gypsum.*

ALBUMEN, the white part of the egg. Dr. Darwin remarks, that there are two kinds of albumen contained in the eggs of birds, one less viscid than the other, and first consumed as nourishment. See *Egg.*

ALBURNUM, an integument, composed of a soft white substance, scarcely perceptible in some sorts of trees, situated between the *liber* and the wood. In the oak and elm, it is hard and very conspicuous. It is as it were an imperfect wood, not having acquired that state or consistence necessary to perfect wood; hence it may be compared to the cartilages in animals, which at length become bone. This state must necessarily be passed through before wood can be formed. The hardness of this substance is in proportion to the vigour of the plant or tree. In respect to its formation, Dr. Darwin observes, that the umbilical vessels of the new buds of deciduous trees, which are analagous to those which permeate the lobes of the seed, are extended downward in the bark about Midsummer, and terminate in certain reservoirs of nutriment, which are at this time secreted from the vegetable blood oxygenated in the leaves. This bark now consists of an intertexture of the caudexes of the present leaves, which were buds in the last summer, and are now adult vegetable beings; and of the embryon caudexes of the new buds; and of the umbilical vessels of the new buds; it will become alburnum or sap-wood during the autumn or ensuing spring, and will be gradually covered over with a new bark consisting of the mature caudexes of the new buds, while that, which was the alburnum in the preceding spring, will become a circle of lifeless timber, interior to the circle of alburnum.

The vessels of the alburnum in their living state, possess the property of conveying the sap-juice, which is propelled upwards in the early spring, by the absorbent terminations of the roots, as visible in decorticated oaks; the branches of which expand their buds, like those of the birch and vine, in the bleeding season. That the vessels of the alburnum in their living state, occasionally act as capillary syphons, through which the sap-juice is first pushed upwards by the absorbent extremities of the roots, and afterwards returns downwards partly by its gravitation, in branches bent below the horizon, appears from an Experiment of Dr. Walker; and lastly, that the vessels of the alburnum, after their vegetable life is extinct, possess a power of capillary attraction of the sap-juice, or of permitting it to pass through them occasionally, appears from the following experiments. First, a branch of a young apple-tree was so cankered, that the bark for about an inch round it, was totally destroyed. To prevent the alburnum from becoming too dry by exhalation, this decayed part was covered with thick white paint: in a few days the painting was repeated, and this three or four times, so as to produce a thick coat of paint over the decayed part, or naked alburnum, extending to the ascending and descending lips of the wound; this was in spring, and the branch blossomed and ripened several apples.

ALCOHOL, a highly rectified spirit, produced from the juices of such vegetable substances as contain saccharine and mucilaginous matters, in considerable proportions, by means of fermentation and distillation. It is chiefly employed to denote the *purest spirit of wine*, or such as has been raised or rectified, by repeated distillations, to its utmost subtilty and perfection. This is the most complete production of vegetable fermentation next to æther. It is perfectly transparent, very thin, simple, totally inflammable, without producing any smoke, or diffusing any disagreeable scent while it is burning, and exceedingly volatile, without leaving any *fæces*. It is absolutely immutable in distillation, extremely expansible by heat, very easily disposed to ebullition by fire, of a very pleasant smell, and a peculiar grateful taste. It coagulates instantly all the humours of an animal body that are known, excepting the pure water and urine. It hardens all the solid parts, and thus preserves both from putrefaction, or spontaneous colliquation. It preserves the bodies of insects, fish, birds, and other animals that are put into it, from corruption, or alteration, if closely stopped. With water, vinegar, any acid liquors, oils, and pure volatile alkaline salts, it suffers itself to be mixed, and that nearly of an equable mixture; gummy and resinous substances it dissolves. We are indeed acquainted with no liquid, produced either by nature or chemical art, that is capable of being united with more bodies than *alcohol*; but in a particular manner it proves an excellent vehicle for the essential oil of vegetables, which, by uniting with it, may be extracted from its proper body, retained, and applied to various uses in the cure of animals.

As there are various instances in which veterinary practitioners stand in need of the true and purest *alcohol*, it is necessary to have some marks by which it may be distinguished whether it be perfectly pure or not. The principal of which are, that if the supposed *alcohol* contain any oil dissolved in it, and so equally distributed through it, that it is no ways perceptible; then upon the pouring of water into it, the mixture will grow white, and the oil will separate from

the *alcohol*: that if any thing of an acid lies concealed in *alcohol*, a little of it mixed with the alkaline spirit of sal ammoniac, will discover the acid by an effervescence; for otherwise there would be only a simple coagulation: that if there be any thing of an alkali intermixed with it, it will appear by the effervescence excited by the effusion of an acid. And as for other salts, they are seldom found in it; but it is a matter of greater difficulty to discover whether there be any water intermixed with it; and therefore chemists have contrived certain methods by which this may also be ascertained: the best is to take a chemical vial with a long narrow neck, the bulb of which will hold four or six ounces of *alcohol*, and fill it two-thirds full with the *alcohol* intended to be examined, into which throw a dram of the purest and driest salt of tartar, coming very hot out of the fire; then to mix them by shaking them together, and set them over the fire till the *alcohol* be on the point of boiling. When thus shaken and heated, if the salt of tartar remain perfectly dry, without the least sign of moisture, it is a sure proof that there is no water in the alcohol.

When used internally, alcohol is highly stimulating to the animal frame. But this, and fermented spirits in general, are of much service when externally applied, in many cases. In its camphorated state, it is very useful for the purpose of resolving inflammations, especially those of the passive kind.

Chemists are not yet agreed as to the constituent principles of this spirituous fluid.

ALDERNEY CATTLE, are a kind or breed of cattle, originally imported from the island of the same name, in general fine boned, but small and ill-made, and of a light red or yellowish colour. Cows of this breed are most frequently met with about the seats of the opulent, probably from their milk, though smaller in quantity, being more rich in quality than that of most other kinds, and yielding a larger portion of cream and butter from the same measure, which is of a beautiful yellow colour, and fine flavour. They are much inclined to fatten, and their beef has a very fine grain, and is well tasted; but rather more yellow or high-coloured than that of other sorts.

Mr. Lawrence, in his general treatise on cattle, however, supposes "that the cattle of the islands on the French coast are collectively known by the name of Alderney." And that "these are a variety of, and smaller than the Norman; light red, yellow, dun, and fawn-coloured; short, wild-horned, deer-necked, with a general resemblance to that animal; thin, hard, and small boned; irregularly, often very awkwardly shaped." But he considers this description to refer chiefly to the cows. He thinks, "they are amongst the best milkers in the world, as to quality, and in that respect, are either before or immediately next to the long horns; but that in weight of butter for inches, they are far superior to all." He has been assured, by a respectable friend, "that an Alderney strayed cow, during the three weeks she was kept by the finder, made nineteen pounds of butter each week, and the fact was held so extraordinary, as to be thought worth a memorandum in the parish-books." And it is added, "that the Norman and island cattle make fat very quick, and, for their bulk, arrive at considerable weight. The beef," in his opinion, "is of the first class, very fine grained, in colour yellow, or of a high colour, with a bluish cast, and elastic feel, which denotes the closest grained, most savoury, and finest meat." It is in his recollection, that, "some years since, a heifer, bred between Alderney and Kentish home-bred stock, and fattened on cabbages and carrots, made one hundred and fifty stone, dying uncommonly fat." On this ground he supposes, "that this species is, in course, a proper cross for the large and coarse boned; but in that view, he would prefer the real Normans from the Continent, as generally better shaped than the islanders." He likewise states, "that many persons near the metropolis, and along the south and western coast, make a trade of importing this cattle, which are extremely convenient for private families, and make a good figure in parks and lawns."

Mr. Culley, however, remarks, that they are a breed of cattle too delicate and tender to be much attended to by the British farmer, and not capable of bearing the cold of this island, especially the northern parts of it.

By an experiment which is stated in the report for the county of Kent, made between a large home-bred cow, of eight years old, and a small Alderney of two years old, it appears that the home-bred cow, in seven days, gave thirty-five gallons of milk, which made ten pounds and three ounces of butter; and the Alderney cow, in the same length of time, gave only fourteen gallons of milk, but which made six pounds and eight ounces of butter.

Very useful cattle may be bred by crossing these cows with short-horned bulls. The late Mr. Hunter also produced a very beautiful little cow from the Alderney by a buffalo, which is said, in the Middlesex Report, to keep plump and fat, both in summer and winter, on much less food than would be sufficient to support a beast of the same size of the ordinary breed.

ALDER-TREE, the name of a tree very common in many parts of England. These trees delight in low moist soils, where few other trees will thrive; and though they will grow and flourish in elevated lands, that are of a sandy or gravelly kind, they have a tendency to impoverish them, and injure all other plants, by their drawing the moisture away in such great abundance. They may be propagated either by layers, or planting of truncheons about three feet in length. The best time for this is in February or the beginning of March; these should be sharpened at one end, and the ground loosened with an instrument before they are thrust into it; lest by the stiffness of the soil, the bark should be torn off, which may prevent their growing. These truncheons should be put into the earth about two feet, to prevent their being blown out of the ground by strong winds, after they have made stout shoots. The plantations should be cleared from all such weeds as grow tall, otherwise they will over-bear the young shoots; but when they have made good heads, they will keep down the weeds, and will require no farther care.

If they be raised by laying down the branches, it must be performed in October; and by the October

following they will have taken root sufficiently to be transplanted out; which must be done by digging a hole, and loosening the earth in the place where each plant is to stand, planting the young trees at least a foot and a half deep, cutting off the top to about nine inches above the surface, which will occasion them to shoot out many branches.

The distance these trees should be placed, if designed for a coppice, is about six feet square; and if the small lateral shoots are taken off in the spring, it will very much strengthen the upright poles, provided a few small shoots be left at proper distances upon the body, to detain the sap for the increase of its size.

These trees may also be planted to advantage on the sides of brooks, as is usual for willows, where they generally thrive exceedingly, and may be cut for poles every fifth or sixth year. The wood of this tree is in great request with the turners, and will, according to Mr. Miller, endure a long time under ground, or when laid in water.

Alder makes a good fence against rivers and streams, and preserves the banks from being undermined by the water, from its constantly sending suckers from the lowest roots. Alder has another beneficial property, which is, that no beast will crop it, in any state, which saves the great charge of fencing it after planting.

It is, however, remarked by Mr. Marshall, in his Rural Economy of Norfolk, that the alder makes the ground it grows on more boggy; and, therefore, for two reasons, ought never to be planted; namely, the injury to the land, and its own trifling value. He also asserts, that it is a great nuisance in meadows, and not only encumbers the spot it grows on, but is allowed on all hands to render moory soils still more rotten. It is a vile inhabitant even in the neighbourhood of a meadow; for its seeds being blown about by the wind, are trodden by cattle into the soil, where, springing up among the herbage, they embitter the grass, and render it unpalitable to the stock.

Mr. South, in the sixth volume of the Letters and Papers of the Bath and West of England Society, has stated, that, on planting a waggon-load of truncheons in such situations as have been described above, they all appeared to succeed by throwing out strong shoots the first summer, but that the year following they all died, not having struck a single root. Concluding that this did not depend on any defect in the soil, he planted it again with small rooted slips, taken from old stubs, few of which failed; most of them having been since repeatedly cut for brush-wood, poles, and other purposes; and of those planted single, he observes, one has formed a conical top of great beauty, and that its bole is three feet seven inches in circumference mid-way, between the branches and the ground. From this statement it would seem that the best mode of securing the growth of these trees is the planting of the rooted slips, which can be easily done, as great quantities of young shoots are annually thrown out from about the roots of this sort of trees.

From the rapidity of the growth, and the beauty of the foliage of these trees, it seems extraordinary that they have not been more frequently planted as ornamental in pleasure-grounds, and upon the banks of ponds and serpentine streams or rivulets: if mixed with the poplar in borders or clumps, a very pleasing variety is formed: they also look well when planted in single trees, and will thrive in springy, gravelly soils, or peat bogs, where but few sorts of trees can be raised.

As timber, this wood is not in any high estimation; it is, however, in demand for the purposes of the patten-makers and cloggers, as well as some kinds of water-works: when charred, it forms an excellent coal for the making of gun-powder.

Where there are plantations, or much of this sort of wood on a farm, Mr. Young advises, that it should be cut when the bark will peel, and be immediately soaked in a pond for two months, as, by this means, the wood is so much hardened as to be greatly improved in its quality. And he thinks it deserves a trial to ascertain whether the same thing would not be the case with other woods of the aquatic kind.

Alder Car, a sort of coarse moist ground or place where alder-trees are cultivated.

ALE, a liquor obtained from the infusion of malt by means of fermentation. It differs from beer principally in having a smaller proportion of hops. There are different sorts of ale brewed, such as the *pale* and the *brown*; the former is made from malt which has been only slightly dried, and is generally considered of a more viscid quality than the latter, which is produced from malt that has been roasted, or very hard dried. See *Brewing*.

Ale that has become flat and stale may be recovered by exciting a new fermentation, by the use of such a proportion of alkaline salt as will exactly neutralise the acid, and restore the briskness. If more than is sufficient for these purposes be added, the liquor will acquire a saline unpleasant taste.

In *farriery* it is sometimes of much use as a cordial, when given to horses and cows, with other substances, as drinks.

ALIMENT, the food of animals, whether of a solid or liquid kind, which should be adapted to their different organs, both in quantity and quality, in order that they may exist in the most perfect state. It is observed, that "nature directs every animal, instinctively, to choose such substances for food as are best adapted to its health and support; but as some are withdrawn from their natural condition for the convenience of man, and, in their domesticated state, are fed on artificial productions not of their own choice, it becomes a matter of serious importance to the owners of cattle, horses, &c. to make themselves acquainted with their nature and habits, and also with the qualities of those substances which are usually designed as food for them; since there is no doubt but errors in the choice of the latter must be a fruitful source of disease. Besides, in the view of the grazier, some sorts of food may be much more advantageous in the quality of fattening animals, than others, which is a circumstance of vast importance.

ALKALI, a chemical term made use of to signify the *fixed salts* of fresh vegetable substances.

Alkalies are distinguished in general by a pungent

taste, the reverse of that of sourness; by their destroying the acidity of all sour liquors, and by their changing the blue and red colours of vegetables to a green: they attract more or less the moisture of the air, and some of them deliquate. The fixed alkalies, which we here consider more particularly, are fusible by a gentle heat: by a greater degree of heat they are, in some measure, dissipated; their fixity, therefore, is only relative to the other kind of alkalies, viz. the vola ile: they dissolve and form glass with earths: and, when joined with acids to the point of saturation, they form what are termed *neutral salts.*

It may be farther observed, that the vegetable fixed alkali, when separated from the foreign matters with which it is mixed in the ashes of vegetables, was formerly considered to be in its purest state; but it is now known that it is still a compound body, and is really a neutral salt, compounded of pure alkali, and fixed air, or the carbonic acid. And that, not only in its pure state, but also when neutralised by the aerial acid, seems always to be one and the same thing, from whatever vegetable it has been produced; except those of some sea-plants: the saline matter produced from which, differs from pot-ash, in containing an alkali of somewhat different properties, which is called soda, or fossil alkali. This is produced by the incineration of the kali and other sea-plants: and from this impure and mixed mass of cinder is obtained the marine, mineral, or muriatic alkali, or *natron,* as it is denominated at present.

This alkali has acquired these names, from its being the base of the common marine or sea-salt. It differs from the vegetable alkali in being more easily crystallizable; and, when dried, not, like the former, attracting humidity sufficient to form a liquid. It is somewhat less pungent to the taste, and, according to Bergman, has less attraction for acids. However, when deprived of carbonic acid or fixed air, and brought to its purest state, it can scarcely, if at all, be distinguished from the vegetable alkali, the true distinction only being formed from their combinations, each of them affording, with the same acid, very different neutral salts. See *Alkaline Salts.*

ALKALINE *Air*, a kind of air arising during the putrefaction of animal and vegetable substances, and also proceeding from ammonia or volatile alkali by means of heat. See *Ammoniacal Gas.*

Alkaline *Salts* are either fixed, that is, not capable of being reduced into the state of gas by any heat that can be applied to them; or volatile, which implies that the ordinary temperature of the atmosphere is nearly sufficient to bring them into that state. Of the former, there are, as has been seen, two sorts, pot-ash or fixed vegetable alkali, and soda or fixed mineral alkali; but of the latter we are only acquainted with one, ammonia, or the volatile alkali.

The fixed alkali are obtained by the combustion of marine and terrene plants; and mineral alkali may be procured from muriat of soda, or sea-salt. The volatile is obtained from urine—animal matter—fossile coal—soot—and other substances. Pure alkalies, as already noticed, possess a peculiar caustic or burning taste, termed alkaline; they change the blue juices of vegetables green, and combine readily with acids, forming neutral salts;—with animal fat, and oil, and vegetable oils, they form soap, or a saponaceous matter, diffusible in water. They are seldom pure, being mostly combined with carbonic acid, in the form of neutral salts. In this state they are termed mild, common, or aërated alkalies.

It is observed by the earl of Dundonald, that alkaline salts act upon and destroy the continuity of the parts of animal and vegetable substances, and that they act most powerfully on the latter when oxygenated, forming therewith saline compounds, which, in a very high degree, promote vegetation.

It is also remarked by the same writer, that oxygenated vegetable matter, and oxygenated peat, when decomposed, and rendered soluble by alkaline salts, assume a brownish red colour, and are tasteless; hence it is supposed, that the alkali must enter into combination, and be neutralised by an acid or acids. These, he says, will be found to be the phosphoric and sorel-line; or, as it is now generally termed, the oxalic acid; forming, according to the particular alkali used, phosphat and oxalat of pot-ash—phosphat and oxalat of soda, or mineral alkali—phosphat and oxalat of ammonia, or volatile alkali.

It is further stated that, by exsiccation, the above-mentioned extract (which is very similar in its colour and effects on ground to the juice of dung-hills) assumes the appearance of a darkish brown gum, soluble at any time by the application of water. Alkaline substances act in the same manner on oxygenated fossile coal, as they do on oxygenated vegetable matters or peat; forming likewise a brownish red liquor, which equally promotes vegetation. The acids contained in oxygenated fossile coal, in a state of combination with calcareous matter, will probably, he thinks, be found to be the phosphoric acid, the acid of borax, and that of sorel, or the oxalic acid.

ALLANTOIS, or ALLANTOIDES, the gut-shaped membrane or vesicle that invests the fœtus of cows, sheep, goats, and other animals of the same kind. It contains an urinous liquor, which is conveyed to it from the urachus.

ALLEY, in the drill husbandry, implies the vacant space between the outermost row of corn on one bed, and the nearest row to it on the next parallel bed. See *Bed.*

In the practice of drilling it was at first supposed that narrow alleys would not answer the ends for which they were intended; while, on the other hand, the making them very wide, would be a loss of ground. About four feet, exclusive of the spaces or partitions between the rows of corn in the beds, was therefore considered as the most suitable and convenient distance.

But it is obvious, that it is not necessary to make the alleys so wide in good soils, as in those of inferior quality; the intelligent husbandman must, therefore, decide what breadth is the most proper in different cases. One circumstance should, however, be duly attended to, which is, that wide alleys are more easily and much better stirred than those which are narrower*: for when an alley is wide, the large furrow in the middle of it may be cut deep, there being then sufficient room to turn the earth over towards the rows;

while, on the contrary, the earth, where alleys are too narrow, cannot be stirred deep enough, nor can room be found for what is turned over out of the furrows, without danger of burying some part of the rows of corn.

Supposing the general breadth of the alleys to be about four feet, the whole of that breadth is not to be ploughed or stirred, either with the plough or cultivator, as soon as the field is sown. Neither of these instruments must go too near the rows of corn, for fear of rooting up the young plants; but a slip of earth about six inches wide is directed to be left untouched on the outside of each bed; by which means the part of the alley that is to be stirred will be reduced to the breadth of three feet; and even that space is lessened in the first ploughing before winter by a deep furrow, which is then cut close to, and all along those six-inch slips, and the earth taken out of each furrow, is thrown into the great furrow in the middle of the alley, which it fills and arches up. These two side furrows make together a breadth of about eighteen inches, and consequently leave, in the middle of the alley, a space of about eighteen inches more, on which is heaped up the earth thrown out of the two furrows: and thus the alleys are to remain during the winter.

By the first hoeing in the spring, the earth heaped up in the middle of the alleys is to be turned back towards the rows of corn. The two furrows that were opened before winter, are then filled up, and a new one is cut in the middle of the alley.

This may be very easily done with the common plough; two turns of that instrument being frequently sufficient for the purpose, one on each side of the alley, as near as possible to the beds. But when these two turns are not sufficient to form the furrow perfectly, or where too much earth remains between it and the bed, a third turn becomes necessary; and sometimes a fourth, in order to hollow the middle furrow as it ought to be.

If this work be performed by the cultivator with two mould-boards, the instrument must be placed in the middle of the alley, and the horses in one of the two furrows. The share readily entering a great depth into the earth, which was laid there by the last hoeing before winter, the horses advancing, the ridge of earth is divided into two parts, and fill up the furrows that were made before winter, on each side of the alley, close to the beds. See *Cultivator*.

Thus the high furrow in the middle of the alley may be opened, and the whole operation performed by a single turn of the cultivator, by which so much time and labour is saved, that the farmer may afford one or two stirrings more in the summer, which will be of great advantage.

Wheat, in this kind of husbandry, is usually cultivated upon ridges of about four feet nine inches in breadth, on which are drilled two rows, ten inches asunder, the distance therefore between these double rows being nearly four feet. These distances, which M. de Chateauvieux denominated alleys, Mr. Tull has called intervals, and the distances of the two rows of wheat upon the ridges he has termed partitions. This agriculturist at first made his ridges six feet broad, and drilled three or four rows upon each ridge; but upon further experience, he found that two rows upon a ridge of four feet nine inches broad, produced better crops than three or four rows upon six feet ridges: and he recommends these double rows to those who cultivate wheat with the hoe-plough. It is likewise observable, that though in his early practice of horse-hoeing wheat, he was cautious of bringing the hoe-plough very near the rows, he found afterwards that there was no danger in hoeing close to the rows of corn, but, on the contrary, the crop was much improved by it, and that the plough, in hoeing the earth from the rows, could not be brought too close to them, unless it tore out any of the plants, insomuch, that he says he could bring the plough within about an inch of the rows when the earth was in right temper for it.

The reason why M. Chateauvieux directed that the hoe-plough should not come close to the rows by six inches, was that he had not then seen Mr. Tull's last Improvements upon the Hoeing Culture, which was not published till several years after the first parts of the horse-hoeing husbandry was translated into French.

By the first horse-hoeing of the crop, which was performed in the beginning of winter, the earth was ploughed away from the rows into the intervals, which formed small ridges in the middle between the double rows. The second hoeing, which was in the spring, turned it back to the rows. The third hoeing was from the rows after the wheat had blossomed; by which the earth is again turned into the intervals, forming small ridges there as at the first hoeing. The fourth hoeing returns the earth to the ridges, which is performed a month or more after the third hoeing: this commonly finishes the horse-hoeings, if the land be in good heart, otherwise one or two more hoeings are necessary. The double mould-board plough is useful to clear the furrows, and lay all the earth up in ridges after the last hoeing; but no cultivators should be substituted in room of the hoe-plough. See *Horse-Hoeing*.

From various circumstances, it is obvious that, in this mode of cultivation, there must be a great loss of ground, and that it must be extremely limited in practice: other modes have, therefore, been since introduced. See *Drill Husbandry*.

ALLODIAL TENURE *of Land*, a free tenure in some parts of Scotland, in which the tenant pays no quit rent, or acknowledges any superior.

ALLOTMENT, a portion of waste or other land, which is set out by commissioners for being enclosed. It also signifies any other sort of thing that is portioned out in lots.

Allotments *of Land*, are those portions of ground that are allotted to claimants on the division and inclosure of commons or other waste lands, and which ought to be proportionate to the extent of right which they enjoy upon them, from the possession of lands, tenements, &c. in the same parish in which they are situated.

ALLUVIAL LIMESTONE, a sort of soft, chalky limestone, found in many districts, supposed to have been formed in the early ages of the world by the de-

position of matters held in the state of solution in water. This kind of limestone Dr. Darwin supposes to contain magnesia, which it probably may have acquired from the sea-water, in which it was originally dissolved. Limestone that contains magnesia has been found, by the experiments of Mr. Tennant, to be much less useful when burnt into lime, for the purposes of agriculture, than such as is purely calcareous. See *Limestone*.

ALLUVION *of the Sea*, land formed by the deposition of various kinds of matters, held in the state of diffusion or solution, either by the sea or large rivers, from their overflowing their banks. The depths of soils formed in this way, are various, according to particular circumstances. Mr. Young, in his able Agricultural Survey of Lincolnshire, when speaking of the fine soil of the lordship of Wintringham, observes, that the marsh land is a tract of alluvion of the Humber, deposited to the depth of six feet, and apparently as good at the bottom as at top.

ALLOWANCES *to Tenants*, such as are agreed to be made to them on their quitting farms, or under any other circumstances.

ALMOND-TREE, a sort of tree generally cultivated in gardens and pleasure-grounds, both on account of the fruit, and for the beauty of its flowers. The flowers frequently, when the spring is forward, appear in February; but when thus early in flowering, if frost comes, their beauty is but of very short duration, and in such seasons few almonds are produced; whereas when the trees do not flower till late in March, they seldom fail to bear plenty of fruit; some of which, from their sweetness, may be fit for the table when green, but they will not keep long.

Almond-trees are propagated by inoculating or ingrafting their buds into plum-almond, or peach-stocks, in the month of July. The next spring, when the buds shoot, they may be trained either for standards, or suffered to grow for half standards, according to the fancy of the owner.

The best season for transplanting trees of this sort, if for dry ground, is in October, as soon as the leaves begin to drop off; but, for a wet soil, February is much preferable; but in whatever season this is done, it is always of importance, according to Mr. Miller, to bud upon plum-stocks for wet grounds, and on almond or peach-stocks for dry.

This tree may likewise be raised from setting the stone of the fruit, which should be done either in autumn or spring, as in October or March, from those of the last summer's growth. They may also be drilled two or three inches deep in a bed of rich earth; and when the plants are sufficiently high, they may be transplanted into proper places.

ALOPECURUS, a genus of grasses of the fox-tail kind, of which there are several species, some of which may be cultivated to advantage in the field.

Alopecurus *Agrestis*, is a grass which has the flowering stems, a foot or eighteen inches in height upright, only a little crooked at the bottom, having three or four joints, smooth and purple. The leaves three inches long, and from a sixth to a quarter of an inch in breadth, roughish on the upper surface only. Miller observes that it is a weed in cultivated ground, and that it is also frequent by way-sides, on banks, and the borders of fields, but rarely in pastures. It varies in the size both of the plant and spike, as well as in the colour of the latter, which is sometimes of a pale green or whitish, without any purple; when in full flower it bends a little. It has also the name of mouse-tail-grass, from the great length and slenderness of the spike, resembling the tail of a mouse. Its inferiority in every respect to fox-tail grass, is so manifest, he thinks, that it would answer no purpose to make experiments with any hopes of bringing it into cultivation; but it flowers early, continues flowering till autumn, and comes into bloom remarkably quick after being sown. Withering says, it is very common in pastures in the Isle of Wight. It is sometimes execrated by farmers under the title of black-bent, according to Mr. Swayne. It is easily distinguished from the meadow fox-tail, which it most resembles by the great length and slenderness of its spikes, and their purple appearance. It is perennial, flowering in May and June.

Alopecurus *Bulbosus*, is a grass, which has a slender stem, about a foot high, sometimes slightly kneed and bent at the lower joint. The spikes are slender, one inch long. The leaves one, or one inch and half in length. The roots are bulbous, emitting many fibres and stems. The awns are rather stiff. Hudson affirms, that in watery places, it becomes the same with flote fox-tail grass. But Woodward has found it in a wet salt-marsh, near Yarmouth, in great plenty, and the flote fox-tail unchanged in the same marsh. It flowers in June and July.

Alopecurus *Geniculatus*, the flote fox-tail grass, which is not only productive, but highly agreeable to different sorts of cattle; but from its being small, and affecting very wet situations, is incapable of being cultivated as a meadow grass. It is perennial, flowering in May.

Alopecurus *Pratensis*, the meadow fox-tail grass, which is an excellent grass either for pasture or hay, and very productive. It is found in the best pastures of many districts in great abundance, and is perhaps one of the better kinds of dairy-grasses. Mr. Curtis observes, that it produces its spike almost, and in some situations to the full, as early as the sweet-scented vernal grass; hence it is equally valuable as an early grass; and that as it is much larger and quicker in its growth, it is consequently much more productive; it shoots very rapidly after mowing, producing a very plentiful aftermath: that where the land is rich, and two crops are not thought too much for it to bear, of all the English grasses this appears to be the best adapted for such a purpose, and ought to form a principal part of the crop: its foliage may appear coarse to some, but it should, he says, be remembered, that no grass can be productive that is not in some degree coarse; if mown early, just as it comes into bloom, though the leaves are large, the hay will not be coarse; in general, the great advantage arising from the earliness of this and the sweet-scented vernal grass is entirely lost at a distance from London, where hay-making commences late, and where the husband-

man seems to wait for a crop of general indiscriminate herbage, rather than of grass.

This grass is somewhat confined as to its place of growth, growing naturally in a moist soil only; hence it is best adapted to improve very wet ground that may be drained of its superfluous moisture, or to form or meliorate meadows that have a moist bottom, and are not apt to be burnt up in dry summers. Others, however, suppose that there is scarcely a better grass for moist lands and clays, from its being very early, and abiding long where the meadow fescue fails. It has also been found hardy against frost and cold, by Mr. Majendie. It is likewise supposed excellent as a hay-pasture, and dairy-grass, by Mr. Sole. It becomes dry soon when cut for hay, and may be stacked much sooner than the other sorts, and particularly when in mixture with other grasses. Its seeds are easily collected; but a great number of them, in certain seasons, are destroyed by a very minute orange-coloured larva or maggot, which feeds on the embryo of the seed, and most probably produces some small species of *musca*. This grass is distinguished, in some degree, by the largeness of its foliage, and by its producing a soft spike on a long stalk early in May. The *meadow cats-tail grass*, or *timothy grass*, produces a spike somewhat similar, but rougher to the touch, and much later in the summer season.

ALTERATIVE MEDICINES, in *farriery*, are such medicines as possess a power of changing the constitution, without any sensible increase or diminution of the natural evacuations.

The principal intention in administering alterative remedies, is that of removing chronic obstructions and other complaints, which do not readily give way to the more active evacuatory methods of treatment: and the medicines that are most commonly had recourse to with this view, are the mercurial and antimonial, though others may be occasionally employed. All remedies of this kind should be given in small doses, and continued for some length of time; and care should be taken that the animal does not catch cold while under such a course.

ALTERNATE *Husbandry*, that sort of management of farms, which has one part in the state of grass or sward, while the other is under the plough, so as to be capable of being changed as there may be occasion, or as the nature of the lands may require. This system of management is supposed to lesson the expense of manure, and keep the land more clean. See *Husbandry*.

ALVEARIUM, a term sometimes employed to signify a bee-hive.

ALVEOLI, the sockets of the jaws of animals, in which the teeth are placed. They are lined with a very sensible membrane, which also incloses the roots of the teeth. The number of them differs in different animals, as well as in animals of different kinds.

ALVEOLUS, the waxen cells in bee-hives.

ALUM, a substance formed by the intimate union of the sulphuric or vitriolic acid with pure clay. It is a salt dissolvable in fifteen times its weight in water. It is frequently produced in great quantities, by the decomposition of alluminous schyst or slate, on exposure to the air, or by calcination; and alum is decompounded by lime, baryt, and magnesia, which combine with the sulphuric acid, and precipitate the alumine. The same effect is produced by pure alkalis; but, if they be added to excess, the alumine which was precipitated is re-dissolved. If a solution of common alum be boiled with a small portion of alumine, the alum appears not only to be perfectly saturated with the earth, but to be supersaturated. The lixivium is then almost tasteless, and when at rest, deposits crystals of a cubic form. One hundred parts of sulphuric acid are saturated with seventy-five parts of alumine, and one hundred parts of the crystals of alum contain twenty-four parts acid, eighteen parts alumine, and fifty-eight parts of water of crystallisation.

It is sometimes found in the native state. It resists putrefaction in a considerable degree, and is injurious to vegetation.

The Earl of Dundonald observes, that Dr. Home, of Edinburgh, the first person who thought of making experiments with saline bodies in promoting the growth of plants, found no beneficial effects to result from the application of alum to garden-mould, the soil on which his experiments were made.

Alum is contained in many soils, and is daily forming in the manner which has been mentioned above. Where found in abundance, the soil is very properly denominated, by country people, a sour soil, on which few vegetables will grow. This sterility, the author just mentioned remarks, is to be corrected by lime, by earthy matters containing magnesia, and by alkaline salts. The neutral salts formed by such applications will be gypsum, Epsom salt, sulphat of potash, sulphat of soda, and sulphat of ammoniac, according to the species of alkali applied. Although no beneficial effects were found to result from the experiments made by the ingenious author who has been quoted above, yet they may with great probability, the Earl of Dundonald supposes, be expected to arise by the application of alum to soils containing much calcareous matter; especially to such as contain, besides this latter substance, a sufficient proportion of animal and vegetable matter. The alum will in this case be decomposed by the calcareous matter, on the principle of superior affinity, whilst the fixable air of the calcareous matter will be disengaged, and, on being absorbed by the roots of plants, will afford them the carbonaceous principle.

This substance is used as a mordant to most colours in dyeing, to prepare leather, paper, and cloths for being printed, and when added to tallow or other animal oils, it renders them harder.

Doctor Darwin also ingeniously supposes, that the use of alum in making bread, consists in its coagulating the mucilage, and perhaps thus contributing to convert it into starch; for the bakers mix it principally with new wheat; and affirm, that it makes the flour of new wheat equal to old.

Where much alum is mixed with bread, it may be distinguished by the eye by a curious circumstance, which is, that where two loaves have stuck together in the oven, they break from each other with a much smoother surface, where they had adhered, than those loaves do which do not contain alum.

Add to this, that alum is also used by the London bakers for the purpose of clearing the river water, with which they are supplied, which is frequently muddy; and also for instantaneously destroying the volatile alkali, which is said to exist in some London wells, owing to the vicinity of dunghills. These purposes it probably fulfils by coagulating the mucilage, which may occasionally be mixed with the water, and support the mud in it; or by uniting with the calcareous earth, or with the volatile alkali which it may contain, and depositing the new-formed gypsum, or its own argillaceous base, the descent of which may carry down other impurities along with it, in the same manner as some muddy wines have been rendered fine, not by filtering them through sand, as then the mud retained on the surface of the sand soon prevents the descent of the wine through it, but by passing clean sand in showers, by means of a riddle, through the wine. Alum is said to be used by the Chinese for the purpose of cleaning the water of some stagnant reservoirs; and when used in small quantity may in all these respects be rather salutary than injurious to the bread of London.

Alum is said also to be used in the manufactory of hair-powder, which should consist of starch without mucilage, that the hair may not be glued together by the perspirable matter of the head, or by an accidental shower. Whether it has the property of converting mucilage into starch, might be easily ascertained by experiment, by washing in cold water alone one parcel of wheat flour, and washing a similar parcel in a solution of alum in water.

In *farriery*, whether exhibited internally or externally, it is one of the most powerful astringent remedies known. In the former case it acts more quickly, and in a smaller dose, than the vegetable astringents, and its effects appear much sooner than could possibly be expected. It is less stimulant, and of more general use, than the metallic astringents. But the most important use of it is, that of a topical application to sores; or to wounded blood-vessels, as a styptic. Burnt alum, finely powdered, and sprinkled on fungous, or what is commonly called *proud* flesh, restrains its growth, or destroys it when already produced. Dissolved in water, and applied on pledgets of tow to ulcers, it promotes their healing; and is useful also when applied as a lotion, to strains, bruises, and other similar cases.

ALUMINE, a term lately employed to signify pure clay. Alumine, aluminous or argillaceous earth, has not hitherto been found perfectly pure in nature, but always in a state of mixture with other earths. The purest is found near Halle in the Duchy of Magdeburg. It is, however, easily obtained artificially, by the decomposition of alum by means of alkalis. The specific gravity of pure alumine is two. It has no taste, and is insoluble in water, although water divides it into minute particles, and forms with it a soft and tenacious mass, which is well adapted for the bases of pigments. It undergoes no change in the atmosphere, nor does it attract carbonic acid. In the fire it is not fused in the least, but greatly diminished in volume, whence the ingenious Mr. Wedgwood made use of it for his pyrometer. When fused with three parts of calcareous earth, it affords glass which scintillates with steel. The fixed alkalis likewise dissolve it in the dry way, and thus form a mass soluble in water. See *Clay*.

ALUMINOUS CLAY, an acid kind of clay, very detrimental to the growth of vegetables, and which greatly counteracts the process of putrefaction in animal and vegetable matters, probably in consequence of its uniting with the ammonia thus produced at the moment of its formation, or by altogether preventing its production. Where this alluminous clay abounds, Dr. Darwin observes, that it is believed to check the vegetation of trees as well as of herbaceous plants, by eroding the fine extremities of their roots, which is perhaps best to be remedied in gardens by wood-ashes or soap-suds, and in larger fields by mixing lime, or chalk in powder, or the sweepings from roads, which are repaired by limestone, with these aluminous clays. Or, lastly, where it can be procured, by mixing with them such lime as that of Breedon in Leicestershire, which consists of equal parts of magnesia and calcareous earth, which would thus fabricate what has been termed Epsom salt, which is said to be friendly to vegetation.

ALUMINOUS *Earth*, a term employed by some writers to signify a sort of vitriolic earthy clay, very unfriendly to the purposes of vegetation. See *Clay*.

ALUMINOUS *Schyst*, a stony substance which frequently accompanies different strata, such as coal, &c. On exposure to the action of the atmosphere it decomposes, and alum is formed. This kind of schyst constitutes the sub-soil of some poor districts.

AMAUROSIS, in *farriery*, is a total blindness without any altered appearance in the eye. See *Gutta Serena*.

AMBERVALIA, a superstitious ceremony practised by the ancient Romans, in order to procure from the gods a happy harvest. It consisted of a procession in which the victims were conducted thrice round the corn-fields before they were sacrificed. Twelve priests walked at the head of the procession, which was composed of all the neighbouring inhabitants, every one being crowned with leaves of oak, and singing hymns in honour of Ceres, the goddess of corn.

AMBLE, in *horsemanship*, is a peculiar kind of pace, in which both the horse's legs of the same side move at the same time. In this pace the horse's legs move nearer to the ground than in the walk, and, at the same time, are more extended: but what is most extraordinary in it is, that the two legs of the same side, for instance, the off hind and fore leg, move at the same time; and then the two near legs, in making another step, move at once: the motion being performed in this alternate manner, so that the sides of the animal are alternately without support, or any equilibrium between the one and the other, which must necessarily prove very fatiguing to him, being obliged to support himself in a forced oscillation, by the rapidity of a motion, in which his feet are scarcely off the ground. For if in the amble he lifted his feet as in the trot, or even in a walk, the oscillation would be such, that he could not avoid falling on his side;

and it is only by keeping his feet very near the ground, and by the quick alternate motion, that he supports himself in this pace, in which the hind-leg is not only to move at the same time with the fore-leg of the same side, but also to gain on it, or touch the ground a foot, or a foot and a half, beyond the spot where the latter grounded. The further the hind-leg extends beyond the place where the fore-leg grounded, the better the horse ambles, and the whole motion is proportionably faster. Thus the whole difference between the amble and the trot consists in this, that the two legs moving together, in the latter, are in a diagonal position, whereas, in the former, the two legs of the same side move together. This pace, which has been shown to be very fatiguing to the horse, is extremely easy to the rider. It has not the shaking roughness of the trot, which is caused by the resistance of the fore-leg, at the lifting up of the hind; because, in the amble, the fore-leg is lifted up at the same time with the hind-leg of the same side; whereas, in the trot, the fore-leg of the same side is at rest, and resists the impulse during the whole time that the hind-leg is in motion.

Those who are skilled in horsemanship observe, that horses which naturally amble, never trot, and that they are considerably weaker than others. Colts often move in this manner, especially when they exert themselves, and are not strong enough to trot or gallop. Most good horses, which have been overworked, and on the decline, are also observed voluntarily to amble, when forced to a motion swifter than a walk. The amble may, therefore, be considered as a defective pace, not being common, and natural only to a very few horses, which, in general, are weaker than others. Add to this, that such amblers as seem the strongest, are spoiled sooner than those which trot or gallop.

There are various methods of discipline employed for bringing young horses to amble: some recommend the toiling of them in their foot-paces, by riding them over rough roads or new ploughed fields, which naturally inures them to the stroke required in the amble; but this disorderly toil is very apt to weaken, and sometimes even to lame young horses. Others attempt it by stopping them in the gallop or trot; so that, by losing both, they necessarily stumble on the amble; but this is apt to spoil a good mouth and rein, and exposes the horses to the danger of hoof reaches, or sinew strains, by over-reaching, &c. Some think ambling by weights the best way, and, in order to do this, either overload the horses with excessive heavy shoes, or fold thick pieces of lead about the fetlock pasterns, without considering that the former are apt to make them interfere, or strike short with their hind-feet; and that the latter, besides that mischief, exposes the horses to incurable strains, crushing of the coronet, breeding of ring-bones, &c. Others again load the horse with earth, lead, &c. which often occasion a swaying of the back, overstraining of the fillets, &c. And farther, some endeavour to make them amble in hand, before they mount their backs, by means of some wall, smooth pale or rail, and by checking them in the mouth with the bridle-hand, and correcting them with a rod on the hinder hoofs, and under the belly, when they tread false; but this is very apt to spoil spirited horses, even before they can understand what you would have them to do.

The best method seems to consist in trying with your hands, by a gentle and deliberate racking and thrusting of the horses forwards, by helping them in the weak parts of their mouths with the snaffle, which must be smooth, big, and full; and correcting them first on one side, then on the other, with the calves of the legs, and sometimes with spurs. If by this means they can be made to fall readily into an amble, though it may be in a shuffling and disorderly manner, much labour will be saved; for the aptness to amble will render the tramels more easy to them, and they will find the proper motion without stumbling, or being frightened. See *Tramel.*

AMEL-CORN, is a diseased sort of grain, the same with spelt. See *Spelt Corn.*

AMELIORATING *Substances*, in *agriculture*, are such substances, whether of the animal or vegetable kind, as, when applied to land, render it more fertile and productive. All the different sorts of dungs and composts are of this kind.

Ameliorating *Crops*, in *husbandry*, are such as are supposed to improve the lands on which they are cultivated; most of those plants which have a large stem and shady leaf are thought to render the soils on which they are grown more fertile, by producing a confined or stagnant state of the air. Carrots, turnips, artificial grasses, such as contain a large proportion of nutritious materials, and many other green vegetable products, are in general considered as ameliorating; but it is probable that all kinds of crops, carried off the land, are in some degree or other exhausters of the ground; and that green crops, such as have been just mentioned, are only less so than such crops of grain or other vegetables as contain large proportions of gluten or vegeto-animal matter in their compositions. The improvement of lands, therefore, by what are commonly termed ameliorating crops, probably depends, in a great measure, upon the culture which the ground receives while they are growing, and the returns which they make to it in the way of manure, after being consumed by animals.

AMERICAN GRASS, a term sometimes applied to a species of agrostis. See *Agrostis Cornucopia.*

AMMONIA, a chemical term applied to volatile alkaline substances. It is formed from the decomposition of all animal and some vegetable matters, during the process of putrefaction. Dr. Darwin observes, that in the decomposition of water, which partially takes place after being absorbed by the roots of vegetables, the hydrogen, by its union with azote, produces ammonia, which may contribute to the nutriment of plants by its mixture with oils, and thus producing soaps, which become diffusible in water; and also by decomposing insoluble saline earths, as gypsum or metallic salts, as vitriol of iron, and by this means producing more soluble or innocuous saline matters.

AMYLACEOUS, a term applied to such farinaceous seeds, grains, and roots, as contain much of the fine flour from which starch is made, and in which chiefly consists their nutritive principle.

ANALEPTIC, in *farriery*, a term applied to remedies of the restorative kind, and particularly such as have a cordial quality.

ANALYSIS, in a general sense, signifies the resolution of compound bodies into their original or constituent principles.

Analysis, of *soils*, the means of ascertaining the nature, properties, and proportions of the different materials of which they are composed. The proper execution of this business enables the farmer to form a just estimate of the value of the different parts of his farm, to make the application of ameliorating substances with propriety, and to understand the effects that may be produced by the combinations of different matters. In order to conduct the process with accuracy and convenience, the operator should, according to the Earl of Dundonald, be provided with two sets of small scales and weights, one to weigh a few pounds at a time, and another smaller and more accurate, for ounces and grains: some porcelaine glass, or stone-ware vessels unglazed, such as are called Vauxhall-ware: some muriatic acid, and mineral alkaline salt. And Dr. Fordyce recommends that he have the sulphuric or vitriolic and muriatic acids; a solution of fixt vegetable alkali in water; some common caustic, or caustic fixt vegetable alkali; caustic volatile alkali, or spirit of sal ammoniac with quick-lime, which is known to be caustic by not effervescing with an acid; ammonia, or sal-ammoniac; galls, and pure water; for if the water contain any metallic or earthy salt, it is improper: in order to try this, pour into a glass of it a few drops of a solution of fixt vegetable alkali in water; if it be impure, the alkali will precipitate the metal or earth; such water is to be purified by distillation or boiling. See *Laboratory*.

It is remarked by the former, that the cultivators of the soil should be able to distinguish, by chemical tests, the proportions of the following substances in different soils, viz. clay, chalk, sand, magnesia, earth of iron, and vegetable matter. And that they should understand the properties and effects, and superior affinities of alkalis and acids; as well as the names, properties, and compounded electrive attractions attendant on the mixture of the different neutral salts, and their effects on vegetation. They should also be well acquainted with the powers of lime, and should clearly and distinctly comprehend the putrefactive and oxygenating processes, as well as the consequences resulting from the action of fire on the vegetable matter contained in the soil.

The first step, says he, that a cultivator of the ground should take, when possessed of the above information, is to ascertain, by experiments, in what proportions chalk, clay, sand, magnesia, and vegetable matter, exist in the soil, in the different parts of the farm he purposes to cultivate; in order that he may, from such information, be enabled to administer to each part those particular substances that it may require, to constitute it rich and fertile mould. A soil of this description ought to contain a due proportion of the simple earths, and of the remains of vegetable and animal bodies. The method of proceeding to ascertain the different proportions of these different substances in soils is as follows: The presence of calcareous matter is ascertained, by applying to the mould suspected to contain it some marine acid diluted with water. If it contain calcareous matter, an effervescence will take place, and a neutral salt, called muriat of lime, will be formed. This is to be separated from the earthy insoluble matter, by a due proportion of water, and is to be evaporated to a certain degree, and the calcareous matter is to be precipitated by mild mineral alkaline salt. When the calcareous matter thus precipitated shall be collected, washed, dried, and weighed, the quantity contained in the soil will be ascertained by the proportion it may bear to the weight of the *dry* mould on which the experiment had been made. The same process and the same acid will serve to show if magnesia be contained, and the proportion it may bear to the soil. Magnesia is not in general found in any very great proportion in surface mould, although there is more of it contained in ground than is generally imagined. It will, for the most part, be found accompanied by calcareous matter; and as both these substances, when dissolved by the marine acid, are very soluble, and blended together, a separation is to be effected by the following process: The earths of magnesia and calcareous matter are to be precipitated by mild mineral alkaline salt. The precipitate, or earthy residuum, when washed, is to be dissolved, by a due proportion of the vitriolic acid diluted with water. With the calcareous matter it will form gypsum (a very insoluble salt), whilst with the magnesia it will form Epsom salt, a salt of great solubility These salts are to be separated by priority of crystallisation; and their respective weights being ascertained, when deprived of the water of crystallisation, and brought to an equal degree of dryness, the quantity of calcareous matter and magnesia in each may be ascertained by Bergman's or Kirwan's tables of the proportion of acid, alkali, earth, and water, contained in different neutral salts. To those who are not provided with such tables, it may suffice to say, that 100 parts of gypsum contain 48 of acid, 34 of calcareous matter, and 18 of water; 100 parts of Epsom salt contain 33 of acid, 19 of magnesia, and 48 of water.

As both clay and sand, in different proportions constituting either a clayey or sandy soil, are distinguishable by the sight and touch, there is no occasion for giving any chemical test, to prove their presence. The proportion of the coarser parts of siliceous matter or sand, in soils or mould, may be ascertained by washing.

The presence of vegetable or carbonaceous matter in surface mould, when in any considerable proportion, is apparent, either from its black colour, or from the vegetable matter, appearing in the soil in an undecayed state. Chemical tests, in either of these cases, are unnecessary. When it may be requisite, however, to ascertain the presence or proportion of it in clayey or other soils, in which, from colour or extreme division of parts, it is less apparent, it is to be done in one or other of the following methods: By properly drying and weighing a certain weight of mould, and then submitting it to such a degree of heat as will consume the vegetable or carbonaceous matter to ashes;

at the same time, the heat must not be such as will disengage the fixable air from any calcareous matter or magnesia that may be contained in the mould or soil submitted to trial. The difference in weight between the dry mould, and that which is thus submitted to the action of fire, will be the proportion of vegetable or carbonaceous matter. It is likewise to be done by melting some salt-petre in an iron ladle, bringing the salt-petre to a red fusion, and then dropping into it, by little and little at a time, the earthy matter, taking care previously to dry it thoroughly. The dropping in of the dried mould should be continued until the complete deflagration of the salt-petre is effected.

The practical observation to be deduced from the above experiment, is, that the soil or mould which contains the most vegetable or carbonaceous matter will deflagrate the greatest quantity of salt-petre; or, in other words, that it will require less mould to deflagrate a given weight of salt-petre, in proportion as that mould contains a greater proportion of inflammable matter.

The presence and proportion of vegetable and inflammable matters in clay may likewise, in some degree, be proved and ascertained by the degree of blackness in the colour, which the interior parts of the clay assume, when subjected in the fire to a certain degree of heat.

The existence and proportion of most saline matters in soils are to be discovered by lixiviation, with warm water, and by subsequent crystallisation. Gypsum is to be detected by boiling the earth with alkaline salts; in which case, the gypsum will be decomposed, and the sulphuric or vitriolic acid of the gypsum will join with the mineral alkali, forming Glauber salt, which is very soluble. The quantity of gypsum previously existing in the soil is to be ascertained by weighing, when properly dried, the calcareous matter which had been precipitated by the alkali; and by adding thereto, in calculation, the proportion of vitriolic acid necessary to constitute it gypsum; having previously deducted therefrom the proportion of fixable air which the precipitated chalk contains. The proportion of fixable air and vitriolic acid contained in chalk and in gypsum are in the proportions as here stated. In chalk, 43 of fixable air; 53 calcareous matter. In gypsum, 48 of vitriolic acid; 34 of calcareous matter. The following this able writer gives as an example of the method of making this calculation:

	Grains.
Residuum of precipitated chalk - -	480
Proportion of fixable air contained therein	212
Calcareous matter - - - - -	268
Proportion of vitriolic acid necessary to constitute gypsum with the calcareous matter - - - - - -	354
Total quantity of gypsum - - - -	622

The processes which Doctor Fordyce advises for ascertaining the substances contained in soils, are—First, To ascertain the quantity of water:

Take one hundred grains of the earth, spread it on a stone plate very thin before the fire, or in the sunshine in a warm day; let it lie till it be thoroughly dry, the water will evaporate, and therefore its proportion will be known by the weight lost. Secondly, To know if there be any metallic or earthy salt:

Take about a pound of soil, pour upon it about a pint of boiling distilled water; stir them thoroughly together, and let them stand for ten minutes; filter off the water through filtrating paper, pour into what comes through, a little of the solution of the fixt vegetable alkali in water; if there be any earthy or metallic salt, a precipitation will take place. Thirdly, To know if the salt contained has calcareous earth for one of its elements:

Take the filtrated solution, pour into it half an ounce of caustic volatile alkali, or continue to drop in this alkali till no further precipitation takes place, afterwards filtrate it, and pour to what filtrates through, a little solution of fixt vegetable alkali; if there be any further precipitation, it shows that there is an earthy salt, consisting of calcareous earth, for one of its elements; if a precipitation took place upon the application of the caustic volatile alkali, it shows that there are either other earthy or metallic salts. Fourthly, To know if the salt contained be metallic or aluminous:

Add to the filtrated solution, an infusion of galls; if there be any metallic or aluminous salt, a precipitation will take place; if iron, a purplish black; if copper or alum, a grey.

Copper may also be distinguished from iron by falling in a blue precipitate upon the application of an alkali, while iron forms a greenish, and alum a white one. Fifthly, To know if magnesia be an element of the salt found:

Take the filtrated solution, apply to it a solution of galls; if no precipitation take place, apply caustic volatile alkali, which will precipitate the magnesia if it be an element of the salt contained. Sixthly, To know if a neutral salt be contained:

Evaporate the filtrated solution with a boiling heat, till the whole water is nearly gone off, and let it stand to cool. If there be any neutral salt, it will crystallise. Seventhly, To know if there be any mucilage, and what quantity:

Take thirty or forty pounds of the soil, boil it in ten gallons of water for an hour, let the earth subside, pour off the clear solution, afterwards add four or five gallons of water to the earth, stir them thoroughly, let them stand to subside, pour off the water clear, mix it with the former, and evaporate the whole to dryness, putting it into a water-bath towards the end of the evaporation; what remains is the mucilage, making allowance for that part of the decoction which was not washed out from the earth, and deducting the saline substances which will crystallise if there be a considerable quantity, but will be destroyed in the operation if in small proportion, as they generally are. Eighthly, To know if there be any calcareous earth in the soil, and what quantity:

Take one thousand grains of the dry soil, apply to it half an ounce of muriatic acid, and four ounces of water in a glass, stone ware, or porcelain vessel, sufficiently large; let them stand together till no more

effervescence takes place; and if it was very considerable, pour in half an ounce more of the acid; let this stand also till the effervescence ceases; if any arose upon pouring it in, continue to add more acid in the same manner, until what was poured in last produces little effervescence, which is often at the first, and generally at the second or third half ounce.

After the effervescence has ceased, put the whole in a filter, let the solution filtrate through; pour half a pint of water upon what remains in the filter, let that filtrate also in the same vessel; add to the solution thus filtrated an ounce and an half of caustic volatile alkali for every ounce of acid used; if any precipitation take place, there is magnesia, earth of alum, or the calx of a metal (generally iron or copper) contained in the soil; after adding the volatile alkali, the whole is to be thrown into a filter again; after the filtration has taken place, pour into the liquor a solution of mild fixt vegetable alkali in water; if there be any calcareous earth in the soil, a precipitation will take place; continue to add the solution of the alkali till no fresh precipitation ensues; throw the whole into a filter, let the liquor filtrate off, pour on by degrees a pint of water, let that filtrate off also; dry what remains in the filter, it is the calcareous earth. Ninthly, To know the proportion of sand and clay:

Take what remains in the filter after the first solution in the foregoing operation, and, by elutriation, separate the sand from the clay; dry and weigh them; if there be any pyrites it will appear in the sand.

In the above processes the principal things to be attended to, are,

Whether there be any metallic or aluminous salts, as these are absolute poisons, and therefore are to be decomposed by quick lime.

Whether there be such a proportion of neutral or earthy salts as to be hurtful; in which case, the solution in *process* (second) will taste salt, a soil containing them in so large a proportion will hardly ever admit of culture for grain.

Whether there be calcareous earth, and in what proportion, as that ascertains the propriety of applying any manure containing it, and the quantity of that manure.

What the proportion of sand and clay is which ascertains the propriety of adding sand or clay.

Whether there be pyrites, as that shows why and when a soil will be long of being brought into cultivation. Pyrites are best destroyed by fallowing, and afterwards applying lime.

M. Giobert found, that one pound of a fertile soil in the vicinity of Turin, contained of carbonic matter, which would burn and flame, about 25 grains, of flinty sand about 4400 grains, of clay about 600 grains, of lime about 400 grains, and, lastly, of water about 70 grains. The same author found that one pound of some barren soils was composed of siliceous earth, about 3000 grains, of argillaceous earth about 600 grains, and of calcareous earth about 400 grains, and it is supposed without any carbonic matter.

Mr. Kirwan ingeniously observes, that the quantity of moisture, which some countries are more liable to than others, should be nicely attended to, at the same time that you estimate the fertility of land by its analysis, as moist climates or situations may require more sand than drier ones; and therefore the same component parts of soil would not be the most fertile, on both the western and eastern coasts of this island; as the former experiences more rain than the latter; nor on the summit, declivity, and base of most mountains, which differ in their degree of moisture.

It appears from hence, says Dr. Darwin, that the chemical analysis of soils is not yet arrived at sufficient accuracy to be depended upon with certainty to discover their degrees of fertility. But as the carbonic part of soil probably contributes most to the growth of vegetables, and next to that the calcareous part, there is reason to conclude, that if a few pounds of different soils are dried by the same degree of heat, and then weighed, and afterwards exposed to a red heat in an open fire, that the soil which loses most weight is probably the most fertile; because the carbonic matter will almost all escape in flame, and almost half the weight of the calcareous earth in carbonic acid.

And another method, he observes, of giving some conjecture concerning the fertility of a soil may be by examining its specific gravity; as the specific gravity of garden-mould is said by Muschenbroek to be 1,630, compared to 1,000 of water. And Fabroni found the specific gravity of barren sandy land to be 2,210 to 1,000 of water. This experiment would not be difficult to try with sufficient accuracy by drying two different soils at an equal distance from a fire, or in the same oven, and then weighing a pound of each in a thin bladder with apertures near its top or neck; and then letting the bladder sink so low into water, as to admit the water through the apertures amongst the soil; and lastly, observing the difference between their respective weights in air, and in water.

ANALYSIS *of Limestone*. See *Limestone*.

ANALYSIS *of Marle*. See *Marle*.

ANALYSIS *of Vegetables*, the process or means by which such bodies are resolved into their constituent or elementary principles. It is effected either by means of heat or the process of putrefaction. In an ingenious work on the connection of agriculture with chemistry, it is observed, that vegetables, by the application of heat, and distillation in close vessels, are resolved into different gasses, liquid matters, and insoluble matter. The gasses consist of inflammable and carbonic acid gas, or fixable air: the liquids, of water, vegetable acids, and oil: the insoluble, of charcoal. By combustion in the open air, charcoal is resolved into carbonic acid gas, or fixable air, soluble, and nearly insoluble compounds. The soluble are, alkaline and neutral salts. The insoluble, for the most part, consist of lime combined with the phosphoric acid, called phosphat of lime.

And by a further, and more intense application of heat, all the constituent parts of vegetables, excepting the earthy, may be changed into the gassious state, and resolved into their simple principles. By combustion in the open air, grain, carrots, potatoes, &c. &c. yield much more alkaline salts than straw, hay, or wood. But neither starch, nor the animalised matter of grain, yield fixed alkaline salts, when burned se-

parately; hence it appears, that the union of these substances is equally requisite for the formation of fixed alkaline salts, as for saccharine matter.

This analysis is, however, far from showing the true state of combination, in which the simple principles of these substances existed in vegetables. The acid phlegm, the empyreumatic oil, the vegetable alkali, or pot-ash, vitriolated tartar, or other neutral salts, are compound matters, or new combinations, produced by the action of heat and decomposition of water, and are substances not only very different from those juices which the plant originally imbibed, but likewise very different from those matters found in the vegetables, after having undergone, by the vegetative process, their full degree of concoction and maturation: whence it is obvious, that neither the precise food of vegetables, nor their component parts, can be ascertained by any analysis of them by fire; at least it is not practicable with the several substances, resulting from such process, to recompose a juice, or fluid, similar to that by which the vegetable had originally been nourished.

It has been stated, that, by an intense degree of heat, all the component parts of vegetables, excepting the earthy, may be resolved into permanently elastic fluids, or gasses; and into the compound substance called water. By vegetables being thus reduced to their simple or elementary principles, they are found to be composed of gasses, with a small proportion of calcareous matter. But although this discovery may appear of small moment to the practical farmer, it is well deserving of his attention and notice, as it throws great light on the nature and food of vegetables, and proves that a large proportion of vegetables consist of the aëry form, fluids or gasses.

But the resolution or separation of the component parts of vegetables by putrefaction, evidently appears far better adapted to answer the inquiries of the chemical agriculturist, than any analysis of them by fire. This process can take place only when attended with air, moisture, and a due degree of heat. Water is decomposed—vital air absorbed—heat disengaged, and new combinations formed, such as gasses—with soluble and insoluble matters. The gasses are—inflammable and azotic, or phlogisticated air, forming volatile alkali and fixable air. The soluble saline matters consist of phosphoric, sereline, or vegetable acid, combined with vegetable, mineral, or volatile alkali. The insoluble matters consist of phosphoric, sereline, or vegetable acid, combined with lime or calcareous matter. These last-mentioned substances may likewise be produced from vegetables which have not undergone the putrefactive process by the tendency which pure air, vital air, or oxygen, has to combine with such like, and all other inflammable substances.

But though analysis has not yet, perhaps, furnished us with an accurate knowledge of the ultimate principles of vegetables, from various facts and observations it is evident that all vegetable bodies may be resolved by means of heat into carbonic acid, water, ammonia, alkaline salts, earths, iron, and manganese, and that the ultimate principles of them are oxygen, hydrogen, nitrogen, carbon, lime, iron, and manganese.

ANBURY, in *farriery*, a kind of wen, or spongy soft tumour or wart, commonly full of blood, growing on any part of an animal's body.

Substances of this kind may be removed either by means of ligatures being passed round their bases, or by the knife, and the subsequent application of some caustic material, in order to effectually destroy the parts from which they arise. The old farriers also made use of a hot iron, in some cases, in removing complaints of this sort; but they are but seldom employed in modern veterinary practice.

ANBURY, a disease in the roots of turnips, which is thus described by Mr. Marshall, in his Rural Œconomy of Norfolk:—It is a large excrescence, which forms itself below the apple. It grows to the size of both the hands; and, as soon as the hard weather sets in, or it is, by its own nature, brought to maturity, becomes putrid, and smells very offensively. At present, the state of three specimens which have been taken up, and examined attentively, is this:—The apples of the turnips are just forming (about the size of walnuts in the husk), while the anburies are already as big as the egg of a goose. They are irregular and uncouth in their form, with inferior excrescences (resembling the races of ginger) hanging to them. On cutting them, their general appearance is that of a hard turnip; but on examining them through a magnifier, there are veins, or string-like vessels, dispersed among the pulp. The smell and taste somewhat resemble those of turnips, but without their mildness, having an austere and somewhat disagreeable flavour, resembling that of an old stringy turnip. The tops of those which are much affected, turn yellow, and flag with the heat of the sun: so that, in the day-time, they are obviously distinguishable from those which are healthy. It seems to be an idea among farmers, that the cause of the anbury, is the soils being tired of turnips; owing to their having been too often sown on the same land. This, however, is, he says, positively erroneous; for the piece from which these specimens were drawn, was an old orchard, and never before bore turnips in the memory of man.

The cause of this disease is probably not yet well ascertained; but if drought does not immediately produce it, the coincidence of a remarkably dry season, and a remarkably anburied turnip crop, justifies a suspicion, that the former does in some measure contribute to promote the latter.

Mr. Marshall seems, indeed, to conceive that it is caused by some kind of grub or other, that, wounding the vessels of the tap-root, diverts the course of the sap; which, instead of forming the apple, forms this excrescence.

ANCHYLOSIS, in *farriery*, a disease of the joints of animals, proceeding from a caries, abscesses in the joints producing caries, ossification of the ligaments, strumous disorders, contraction of the tendons, and some other similar causes.

Where the bones are united, the cure is impossible; and whatever else is the cause, the cure is very uncertain, on account of the difficulty of coming at the seat of the disease; and, indeed, often from the difficulty of knowing what part about the joints is the

part primarily and principally affected, or even in any degree the cause of the complaint.

ANEURISM, in *farriery*, a throbbing tumor, produced by the dilatation of the coats of an artery in some part of the body of an animal. It is of course obvious, that the arteries only are the seat of this disorder; and that any artery, in any part of an animal, may be thus affected, as any vein may be the seat of a varix. But whether cattle of any description are liable to this disease, has not been shown by veterinary writers; it is however observed by Mr. Boardman, that, by the fairest analogy, it may be supposed possible; or, at least, that an aneurism may be produced, if not spontaneously, at least by *accidental violence*.

Aneurisms in the limbs may be cured by making an incision, exposing the artery, and tying it above and below the tumor with a proper ligature.

ANGINA, in *farriery*, a name sometimes applied to the quinsey, or what in animals is termed anticor. See *Anticor*.

ANGLERS, persons who follow the business of taking fish with the hook; they are highly injurious to salmon-streams, by taking the young samlets in their passage down them, and ought, of course, to be prevented by an act of parliament made for the purpose. See *Fisheries* and *Water*.

ANGLE-BERRY, in *farriery*, a sort of fleshy excrescence, to which cattle and some other animals are subject. According to Mr. Topham, "they are mostly dry, cutaneous tumors, growing out above the surface of the skin; being either hard or soft, greater or less, broad or long, complicated or entire," under different circumstances; and are supposed to proceed from a rupture of the cutaneous vessels, which give vent to a matter capable of forming a *sarcoma*, or fleshy excrescence. They frequently appear upon the belly, and adjacent parts, hanging down in a pendulous manner.

They are found to differ greatly in their disposition, according to their different situations and magnitude, and the degree of sensibility of the part on which they happen to be placed. Such as arise from a small base, and hang as it were from a stalk, are commonly removed by a ligature fixed round their bases, and gradually straightened until the excrescence falls off. But when they have a large base, and happen to be situated upon any joint, they should be treated with great caution, and also when situated near the tendons, cartilages, &c. for a caustic applied in too great quantity, might do irreparable mischief. In these cases, the taking them off skilfully by incision is best; but even this must be done cautiously, as instances have happened, where too free a use of the knife has caused a loss of motion in the joint, or brought a flux of humours upon the part, so as to destroy the cartilage, and even the bone itself. Such an accident renders the cure worse than the disease.

The above writer advises, that "where the base of a tumor of this kind is large, to fix a ligature round it, and draw it tight; then with a sharp and suitable knife, a small distance from the ligature, to cut off the tumor or lump. After which, blood will issue out of the vessels in proportion to their size and situation; which may be suppressed by a hot iron applied to the mouths of the bleeding vessels, having the part of the iron very smooth which is applied to the wound, and continuing to apply the iron, sufficiently hot, where the flux of blood issues out, till an eschar is formed over the vessels thick enough to resist the flux of blood. The ligature may remain on till the danger of bleeding is over. Afterwards the part may be poulticed once a day, to bring the wound to discharge good matter; after which, dressing it with common ointment, will be sufficient for the cure. And where the neighbouring parts abound with small tumors of the same kind, it is directed to rub them over two or three times with equal parts of oil of vitriol and sweet oil, taking care not to let the application spread to the sound parts. Where these tumors do not waste, or seem to die after a few applications, they may be cut off with a sharp knife, as already directed.

Tumors of this kind may be prevented from returning, by touching their roots with a little of the *lapis infernalis*, oil of vitriol, *aqua fortis*, or butter of antimony; or it may be sufficient to sprinkle a little red precipitate on the affected part or tumor.

ANGORA GOAT, a particular kind of goat. See *Goat*.

ANIMAL, a creature that is endowed with life, and mostly with spontaneous motion, though in some cases without it. They are distinguished in general from vegetables, by having motion, though this gives us no perfect definition; as there are entire classes of animals which are fixed to a place; as the *lithophytes* and *zoophytes*, which are produced and die upon the same spot; and, on the other hand, certain vegetables have as much motion in their leaves and flowers as certain animals, as shell-worms, for instance. However, by attending to the most general characters, they may be defined to be bodies endued with sensation and motion, necessary to preserve their life. They are all capable of reproducing their like: some, by the union of the two sexes, produce small living creatures; others lay eggs, which require a due temperature to produce young: some multiply without conjunction of sexes; and others are reproduced when cut in pieces, like the roots of plants. Excepting man, all the other animals have been divided into eight different classes; but which are not necessary to be inserted for our present purpose.

In respect to the principles of animal bodies, their analyses has fully shown that they are principally constituted or composed of water, jelly, albuminous matter or lymph, saccharine matter, or sugar, fat, resin; the fibrous part of blood or muscles, salts, and calcareous earth. It is therefore evident, that animal bodies are much more compound than vegetables. Mr. Jacquin, however, observes, that "Both have some parts in common, as water, saccharine matter, and lime. Other parts, on the contrary, are peculiar to each; thus plants contain volatile oils, and some essential salts, whilst animals contain albumen, which, in vegetables, is met with in small quantity only. Finally, although some of the constituent parts of animals and vegetables resemble each other in some degree, yet they appear under circumstances by which they may be easily distinguished from one another." And that "such constituent parts are animal jelly, which, though it agrees in many of its properties with

vegetable mucilage and gum, is yet sufficiently distinguished from these bodies, on account of the difficulty with which it dries, the property of attracting humidity from the atmosphere, its change to a tremulous mass, and its greater tendency to putrefaction. Thus also the fibrous part of muscles possesses almost all the properties of the gluten of farina, yet it differs from this substance in its greater tenacity and elasticity. Moreover, the proportion of this substance is much greater in animals than that of gluten in vegetables." And lastly, "that animal fat and resin differ from expressed oils and vegetable resins, even in many of their external properties or qualities."

It is also found, that "the salts of the animal kingdom differ, in like manner, from those of vegetables. Beside the small quantity of muriatic acid and soda, found in both kingdoms, and the sebacic acid, which is much more abundant in animal fat than in expressed vegetable oils, the vegetable kingdom is distinguished by the oxalic, tartareous, malic, citric, and benzoic acids; and the animal kingdom by the lactic, phosphoric, lithic, and formic acids, and the basis of the saccharine acid of milk." And it is concluded, that, "all these proximate principles of animals may be resolved into the following remoter principles, viz. oxygen, hydrogen, nitrogen, carbon, phosphorus, lime, and iron. These are precisely the same in plants, with this difference, that the quantity of phosphorus and nitrogen in the latter is very small, which bodies, on the contrary, form a constant and principal part of animals of every description.

It is further evident, that "all animal substances enter into the state of putrefaction as soon as they are dead, or deprived of organic power. Some, it is true, undergo previously the acid fermentation, but the duration of it is only momentary. The phenomena which accompany this putrefaction, differ not only from those of vegetables, but even according to the circumstances under which this change of animal bodies takes place." It is found that the putrefaction of animal substances is most facilitated, first, by sufficient moisture; secondly, by access of atmospheric air; and, thirdly, a temperature of about 10 degrees of Reaumur, or somewhat more. "If any soft animal part, for instance, a piece of flesh, begin to putrify under these circumstances, it becomes paler, softer, and begins to lose its consistence and texture; it then exudes a fluid similar to lymph, and smells faint and nauseous. Soon after it decreases in volume, and becomes still less consistent; its smell is then more acrid and ammoniacal; and in this state it effervesces with acids, and changes the juice of violets green. The ammoniac volatilizes by degrees, and, at the same time, that peculiar putrid penetrating gas is emitted which acts so dreadfully, and with such violence upon the animal body, and of which neither the cause nor the constituent parts are perfectly known, though some consider it merely as a mixture of phosphorated and carbonated-hydrogen gas. This period is of long duration; the putrescent mass again swells up, and developes a considerable quantity of carbonic acid gas. It is now perfectly disorganized, and the whole is changed into a soft putrid mass of a brown or green colour, which resumes its former faint nauseous smell, and dries at last into a dark brown friable substance. The shortest period in which a solid animal substance putrifies, under the circumstances above-mentioned, is estimated at eighteen months, and the longest at three years." But, "the putrefaction of liquid animal substances, and of solid animal parts in water, proceeds much quicker. Animal bodies putrify, on the contrary, considerably slower in closed vessels, as well as in the earth. In the latter case, the circumstances of the putrefaction differ according to the quality of the earth. If the earth be very dry, light, and sandy, and sheltered from the air and rain, it imbibes, in a short time, all the liquid parts, so as to occasion a want of that humidity in the animal part required for putrefaction, which is thus not only retarded, but frequently altogether obstructed. On the contrary, in argillaceous earth, and under the atmosphere, the putrefaction is promoted by the continual supply of moisture. The earth, in this case, absorbs the substances recently produced, and becomes black, unctuous, and fit for the growth of vegetables." And it has "been observed, in a few rare instances, that, when a great number of carcases are buried without any intermediate spaces of earth, they do not, in this case, undergo a true perfect putrefaction, but are entirely changed, the bones excepted, into a substance similar to fat, soluble in water, analogous in its chemical properties to soap, and composed of a peculiar kind of fat and ammoniac. The bodies, which would otherwise escape in the form of gas, are here arrested, and the hydrogen, it should seem, combines, in some measure, with nitrogen, and, as usual, forms ammoniac, and partly with carbon, constituting the peculiar oil, which, with ammoniac, produces a saponaceous substance or material."

It is of course obvious, that the putrefaction of animal substances is perfectly similar to that of plants of some sorts, except that, on account of the greater quantity of phosphorus and nitrogen, a greater portion of ammoniac and phosphorated hydrogen gas is obtained, and that the smell is much stronger, and more noxious or disagreeable.

These observations may be applied with advantage to such animal substances as are employed as manures.

Animal *Manures*, are those manures that are procured from different animal matters, such as flesh, blood, hair, wool, horns, bones, feathers, tallow-chandler's graves, &c. They are in general considered as more powerful in promoting vegetation than those which are derived from vegetable substances. From their being in general obtained only in small quantities, they are for the most part employed in mixture with other substances; and, from their known property of promoting fermentation when thus incorporated, they may be of great advantage in forwarding the putrefaction of such materials as are intended for manure. And as ammonia is formed in large quantities during the decomposition and decay of all such substances, they may be very beneficially united with good vegetable mould, or peat earth, as, by the action of that substance upon them, they are rendered more capable of supporting vegetation. See *Manure*.

ANIMALIZED *Matter of Vegetables.* See *Vegeto-Animal Matter.*

ANJOU *Cabbage*, an excellent vegetable both for the kitchen and the food of cattle. An ingenious agriculturist, the marquis de Turbilly, has given the following instructions for the cultivation of it:

The great Anjou cabbage, is, he observes, one of the most useful leguminous plants for country use. It will grow in almost any soil, not excepting even the most indifferent, provided it be sufficiently dunged. It is but little known about Paris, and in many other places in France, where it might be cultivated to great advantage.

The seeds of this cabbage are commonly sown in June, in a quarter of good mould, in the kitchen-garden, and watered from time to time in case of drought. The plants will rise pretty speedily, and should be thinned soon after, wherever they stand too thick. The next care is to keep them free from weeds whilst they continue, by hoeing the ground between them. About the first of November (probably September or October would be better in this climate), they should be transplanted into the field where they are to remain. They should be planted there in trenches dug with a spade, pretty deep; that is, they should be buried almost up to the leaves. The distance between them should be two feet or two feet and a half every way, according to the goodness of the soil. Particular care should be taken never to plant them with a dibble, as gardeners plant other sorts of cabbages. A layer of dung should be spread along the bottom of the trench, and the roots of the transplanted cabbages covered therewith. The mould taken out should then be returned back upon the dung; and as the trench will then no longer hold it all, there will remain a ridge between each row of cabbages.

Towards the middle of the ensuing May, the ground should be well stirred between the plants, with a spade, or some other proper instrument, and its whole surface laid quite level. After this, nothing more remains to be done, except pulling up the weeds, from time to time, as they appear.

Many husbandmen sow the seeds of these cabbages with those of hemp; and though this may not be so sure as the former, it often succeeds very well, especially in wet years. When the hemp is pulled up, a multitude of little cabbages are seen, and which, having then a free air, grow apace. They are transplanted about the first of November in the manner before directed, and are preferred to those of the kitchen-garden, because they are not so apt to run up to seed the next spring; an accident which sometimes happens to a few of these cabbages, in certain years; and it then becomes necessary to replace them by others which have not run up, and which are reserved for this purpose in a separate spot of ground.

Several farmers use a plough to cut the trench for transplanting these cabbages; but then they do not remove them till the spring, leaving them, in the mean time, in the place where they were sown. They afterwards give the earth a stirring with the spade, and lay it smooth towards the end of May, in the manner before directed. Whole fields of these cabbages may be seen on many farms in those provinces which formerly bore the names of Anjou and Poitou, and which prove a very useful resource as cattle-food.

In the month of June, such of these cabbages as are already large, and do not turn in their leaves for cabbaging, but still continue green, begin to be fit for use, and soon arrive at their full perfection, which they retain till the next spring, when they begin to run up, and afterwards blossom. Their seeds ripen towards the end of July, and what is intended for sowing should then be gathered.

In Anjou, when these cabbages are entirely run up, they generally grow to the height of seven or eight feet: sometimes they reach to eight feet and a half, or nine feet; nay, some have even been seen of a greater height.

From the month of June, when these cabbages begin to be fit for use, their leaves are gathered from time to time, and they shoot out again. They are large, excellent food, and so tender that they are dressed with a moment's boiling. They never occasion any flatulencies or uneasiness in the stomach; and are also very good for cattle, which eat them greedily. They likewise greatly increase the milk of cows. Such are the properties of this kind of cabbage, which is greatly esteemed in the districts formerly denominated Anjou, Poitou, Brittany, Le Maine, and some other neighbouring provinces. In the first, farmers were formerly bound by their leases to plant early a certain number of these cabbages, and to leave a certain number of them standing when they quitted their farms.

This cabbage forms a kind of shrub, the great utility of which may be gathered from this, that its leaves afford nourishment to men and cattle; and its stalk, which is about the thickness of one's wrist, is used, when dry, for fuel. It sometimes happens, in extremely severe winters, that some of these cabbages are frozen; and this, in the above provinces, is considered as a very great loss; but that accident is rare, because this kind of cabbage resists frosts better than most others.

The ground where these cabbages are planted should be fenced in very carefully by hedges or ditches, to preserve them from the depredations of cattle, which are extremely fond of them. With this precaution, the marquis observes, he has made several plantations of them, near the houses erected in the midst of the heaths and commons he has broken up and improved; and they have succeeded very well, though the soil was but indifferent in many places.

He says he has, near his house in Anjou, "two well inclosed fields, destined for this sort of plantation. They are planted alternately with young cabbages. When these are pulled up, after they have seeded in the second year, at the time already mentioned, the ground where they stood is dug up, and sown with peas or beans; the crop of which being taken off before the first of November, makes room for planting new cabbages at the proper season. The soil is loosened and enriched by the peas and beans, and by this means the land is never rested; nor is it ever exhausted, because it is dunged whenever the cabbages are planted. These cabbages, he remarks, are of such service to him, that he has often wondered

at their not being cultivated in all the different countries of Europe. He thinks they would succeed any where, and advises husbandmen every where to make plantations of them. He also hopes that this short account, founded on his own experience, may contribute to extend the culture of so useful a plant." See *Cabbage*.

ANNOTTA, or ARNOTTA, in rural economy, is a colouring substance, said to be obtained from the skin or pulp of the kernel of the *bixa* of South America, or of the shrub when cultivated in our gardens. See *Bixa*.

Of the preparation of this matter from the red pulp which covers the seeds, Mr. Miller gives the following account: The contents of the fruit are taken out and thrown into a wooden vessel, where as much hot water is poured upon them as is necessary to suspend the red powder or pulp, and this is gradually washed off with the assistance of the hand, or of a spatula or spoon. When the seeds appear quite naked, they are taken out, and the wash is left to settle; after which the water is gently poured away, and the sediment put into shallow vessels to be dried by degrees in the shade. After acquiring a due consistence, it is made into balls or cakes, and set to dry in an airy place until it be perfectly firm. Some persons first pound the contents of the fruit with wooden pestles; then covering them with water, leave them to steep six days. This liquor being passed through a coarse sieve, and afterwards through three finer ones, it is again put into the vat or wooden vessel, and left to ferment a week; it is then boiled until it be pretty thick, and when cool spread out to dry, and then made up into balls, which are usually wrapped up in leaves.

Annota, when of a good quality, is of the colour of fire, bright within, soft to the touch, and capable of being dissolved in water. But the substance commonly met with in the shops under this name is a preparation made by the druggists, in which madder is probably a principal ingredient; it is of a brick colour, and a hard compact texture. It is a drug much used in Gloucestershire, and other counties, and in the butter-dairies of both this country and Holland.

The method of using the soft or genuine sort is simply by dissolving such a quantity as is necessary in a small portion of milk, allowing such particles as will not dissolve to settle to the bottom. The milk thus coloured is then poured off, and mixed with that which is to be made into cheese. But when the hard preparation is used, pieces of it are frequently under the necessity of being rubbed against a hard smooth even-faced pebble or other stone, being previously wetted with milk to forward the levigation, and to collect the particles as they are loosened. For this purpose a dish of milk is generally placed upon the cheese-ladder; and, as the stone becomes loaded with levigated matter, the pieces are dipped in the milk from time to time, until the milk in the dish appear to to be sufficiently coloured. The stone and the "colouring" being washed clean in the milk, it is stirred briskly about in the dish; and, having stood a few minutes for the suspended particles of colouring-matter to settle, is returned into the cheese-cowl; pouring it off gently, so as to leave any sediment which may have fallen down in the bottom of the dish. The grounds are then rubbed with the finger on the bottom of the dish, and fresh milk added, until all the finer particles be *suspended:* and in this the skill in colouring principally consists. If any fragments have been broken off in the operation, they remain at the bottom of the dish: hence the superiority of a hard closely textured material, which will not break off or crumble in rubbing. The price is about ten-pence an ounce; which will colour about twenty thin cheeses of from ten to twelve pounds each. The colouring therefore costs about a halfpenny a cheese.

ANNUAL HOLDING, a tenure of land, in which the tenant has only a yearly interest or certainty of possessing the land. These sorts of holdings are, Mr. Marshall says, most discouraging to tenants, and at the same time highly unfriendly to improvements in agriculture, and, in a public point of view, of course impolitical; while to the proprietor extremely convenient, as he may be said to be in constant possession of his estate, being able to carry on improvements of every description without controul. It would, of course, he thinks, be unwise on a farm, where this sort of tenure exists, to alter it till such necessary improvements have been planned or marked out and brought into a state of execution. Whatever discourages agriculture cannot, however, he thinks, be permanently profitable either to the proprietor or the general interest of the country; and, in respect to present profit, such holdings are extremely disadvantageous to the former. It is justly concluded, that a good tenant, who has understanding and capital, will give ten per cent. or a greater proportion more, for a farm on a lease of twenty-one years, than for the same on an uncertain tenure. See *Letting of Farms and Lease*.

ANNUAL *Meadow-grass*. See *Poia Annua*.

ANNUAL *Plants*, are such as are only of one year's duration, or which come up in the spring and die in the autumn. They are frequently denominated simply *annuals*. Wheat, oats, barley, beans, peas, &c. are of this kind.

ANNULAR, having the form or resemblance of a ring. This appearance is observed in the wood of some kinds of trees after they have been cut down; and in the horns of cattle and sheep, by which their ages may in some measure be ascertained.

ANODYNE, in *farriery*, a term applied to such medicines as ease pain, and procure sleep. It is now generally applied to those remedies only which relieve pain by diminishing or destroying sensibility. Animals, in general, require large doses of these sorts of medicines.

ANOREXY, in *farriery*, a term applied to a want of appetite, which, in brutes, is seldom an original disease, but a consequence or effect of some other. See *Appetite*.

ANT, a sort of insect, extremely injurious to pasture lands and gardens; in the former by throwing up hills, and in the latter by feeding on the fruit, &c. The best methods of keeping them from trees, are those of having the earth round them constantly dug

up, and the application of saw-dust, coal-ashes, or other matters of the same kind, about their roots. The same purpose may be effected by covering the bottom part of the trees with tar; but, as it is prejudicial to the trees, night-soil may, perhaps, answer better; as it is found to destroy them when spread upon or put into their hills.

A liquor, prepared by boiling rain-water, with black-soap and sulphur, has lately been made use of by M. Tatin, for destroying those animals, it is said, with considerable success. Where this liquor is employed, care should be taken that the ground where they inhabit be perfectly saturated with it.

Ant-*Hills*, are the habitations of ants, and consist of little eminences, composed of small particles of sand or earth, lightly and artfully laid together. These hills are very detrimental to the farmer, depriving him of as much land as the hills cover; which may often be computed at a tenth part, or more, of his grass-lands. And in some places, where negligence has suffered them to multiply, almost half of it has been rendered useless; the hills standing as thick together as grass-cocks in a hay-field: and what is very surprising is, that, by some, this indolence is defended, by affirming, that the area or superficies of their land is thereby increased; whereas it is well known that very little or no grass ever grows thereon; and, therefore, if the surface be increased, the produce is proportionably decreased.

In order to remove the hills, and destroy the insects, it has been a custom in some places, at the beginning of winter, and often when the weather was not very cold, to dig up the ant-hills three or four inches below the surface of the ground, and then to cut them in pieces, and scatter the fragments about: but this practice only disseminates the ants, instead of destroying them, as they hide themselves among the roots of the grass for a little time, and then collect themselves together again upon any little eminence, of which there are great numbers ready for their purpose, such as the circular ridges round the hollows where the hills stood before. It is, therefore, a much better method to cut the hills entirely off, rather lower than the surface of the land, and to let them lie whole at a little distance, with their bottom upwards: by this means the ants, which are known to be very tenacious of their abodes, continue in their habitations until the rains, by running into their holes of communication, and stagnating in the hollows formed by the removal of the hills, and the frosts, which now readily penetrate, destroy them. If a little soot were sown on the places, and washed in with the rains, it would probably contribute greatly to the intended effect. The hills, when rendered mellow by the frosts, may be broken and dispersed about the land. By this method of cutting the hills, one other advantage is gained; the land soon becomes even and fit for mowing, and the little eminences being removed, the insects are exposed to the wet, which is very disagreeable and destructive to them.

Where these hills are to be cut off, Mr. Young advises its being done by a plough for the purpose, many of which have been invented, as they do the work of many men.

It would, perhaps, be a better practice than that of suffering the hills to remain on the ground, to collect the parts of them which have been pared off into a heap, in some convenient place, and then form them into a compost, by mixing a portion of quick lime with them.

In wet weather these insects are apt to accumulate heaps of sandy particles among the grass, called by labourers spront-hills, which quickly take off the edge of the scythe. These hills, which are very light and compressible, may be conveniently removed by frequent heavy rolling.

In the Rural Œconomy of Norfolk, a practice of cutting and burning the ant-hills that are formed on grass-land, is mentioned. The process is, to cut them up with a heart-shaped sharp spade or shovel, in irregular lumps of from ten to fifteen inches diameter, and from two to five or six inches thick. These are to be turned the grass-side downwards, until the mould-side is thoroughly dry, and then to be set the grass-side outwards, until they are dry enough to burn. The fire may be kindled with brush-wood, and kept smothering, by laying the sods or lumps on gradually, as the fire breaks out, until ten or fifteen loads of ashes are raised in one heap, which the workmen formerly completed for a shilling or eighteen-pence each load of ashes. The places from which the hills have been removed may be sown with grass-seeds. Besides the destruction of the ants, this is a ready, though by no means an œconomical, way of raising manure, and in some cases ought not to be neglected, on grounds where such a process is required. On some soils ashes are found in themselves an excellent manure; and, perhaps, generally, ashes raised in this way, would be found highly advantageous as bottomings for farm-yards and dung-hills.

But, in the sixteenth volume of the Annals of Agriculture, Mr. Young recommends the method of rolling down ant-hills, instead of cutting them; and says, that he rode over a large pasture, which he should not have known had ever been infested with these hills, if he had not been assured that it was once covered with them. No other method had been used but repeated rollings with a very heavy roller.

ANTHELMINTIC, in *farriery*, a term applied to such remedies as are supposed to destroy or carry off the worms which lodge in the intestines of an animal. See *Botts*, *Worms*, &c.

ANTHOXANTHUM, a genus of grasses, of which only the following seems useful for cultivation as a field-grass: It is the vernal grass.

Anthoxanthum *Odoratum*, the sweet-scented vernal grass, which, from its coming into blossom very early, and being found to grow readily in most soils and situations, as in bogs, places shaded with brush-wood, rich meadows, and dry pastures, must be considered as a valuable grass. In point of crop, Mr. Curtis, however, thinks that it is not so productive as some, yet more so than others; cattle are, he says, fond of it, and it is well known to be the only English grass which is odoriferous, the agreeable scent of new-made hay arising entirely from this grass; hence its name of *odoratum*, or *sweet-scented:* the green leaves, when bruised, readily impart this perfume to the fingers, by which means the foliage may

at all times be known; and persons not deeply skilled in botany may distinguish it when in blossom, by its having only two threads or stamina to each flower. This is the least productive in point of seed of most of the field-grasses. In certain situations, and more especially in dry seasons, the leaves of it are apt to be blighted, from a disease which changes them to an orange hue, and which has proved highly injurious to the plants, when cultivated, in many places. It thrives well in soils of the poor sandy kind, and may be introduced in any in a slight proportion.

ANTICOR, in *farriery*, a disease among horses, arising from an inflammation in the gullet and throat, or a kind of quinsey. The swelling sometimes extends as far as the sheath; and is attended with fever, great depression, weakness, and a total want of appetite.

The signs of this disease, according to the best writers on the subject, are a swelling in the breast of the horse, which sometimes rises upwards along the gullet, and threatens suffocation. The animal hangs down his head, and groans much when he is laid down, forsaking his food; neither can he stoop to grass or hay upon the ground. He has a faultering in his fore-legs, and, on being tied up, is like to tumble, with a trembling of the whole body.

The disease is not common to horses in this country; but when it occurs, the cure should at first be attempted by large and repeated bleedings, in order to abate the inflammation; emolient laxative clysters, where the horse is costive, should afterwards be injected twice or thrice a day. The swelling may be bathed with any cooling saturnine wash. By this method, continued four or five days, the inflammation in the throat and gullet may frequently be removed. Cooling drinks may likewise be given, in this stage of the disease, with considerable advantage. But when the swelling proceeds and matter is formed, the tumor, when brought into a soft state by the use of poultices or other means, may be opened with a knife, and dressed with some mild digestive application.

It seems probable that, in general, the disorder proceeds from hard riding, exposure to cold, and giving cold water to drink when hot, full feeding, and whatever causes sudden inflammation.

ANTIMONY, in *farriery*, a blackish mineral substance, of a shining striated appearance, hard, brittle, and very heavy. It is employed as a remedy in many diseases of horses and other animals, and is said to have been given to fattening cattle and hogs with advantage. An ounce is the common quantity for a full-grown animal, which may be repeated according to circumstances.

ANTIMONIALS, in *farriery*, such remedies as are either wholly or in a great part composed or constituted of antimony. These are remedies of great use in veterinary practice.

ANTINEPHRITIC, in *farriery*, a term applied to such remedies as are proper in diseases of the kidneys. See *Kidney*.

ANTIPARALYTICS, in *farriery*, a term used to signify such medicines as are calculated to cure the palsy. See *Palsy*

ANTIPLEURITIC, in *farriery*, a term applied to such remedies as are used against the pleurisy. See *Pleurisy*.

ANTISEPTICS, in *farriery*, are such remedies as resist or correct putrefaction. Bark is a principal remedy of this kind.

ANTISEPTIC *Substances*, in *agriculture*, are such substances as have a tendency to resist the putrefaction and decay of animal and vegetable matters, when united with them either beneath the soil or upon its surface, and in the dung or compost heap. Aluminous and vitriolic substances are mostly of this kind, and likewise the astringent principle of different vegetable matters.

ANTISPASMODICS, in *farriery*, are such medecines as are suited to cure spasmodic affections. Opium, assafœtida, and the essential oils of many vegetables, are the most powerful remedies of this kind.

ANTIVIRGILIAN *Husbandry*, a title by which the drill or horse-hoeing husbandry, as improved by Mr. Tull, is sometimes distinguished by writers on agriculture.

AORTAL *Arteries, of vegetables*, the large vessels destined to convey the elaborated juice or blood of plants to the leaves and extremities, are so denominated by Dr. Darwin.

AORTAL *Veins, of vegetables*, the large vessels which bring the sap-blood or juice of plants from the leaves and extreme parts, have been lately so termed by some writers on vegetation.

APERIENTS, in *farriery*, are such remedies as are calculated to keep the bowels of animals in a gentle open state.

APHERNOUSLI, or ARKENOUSLI, a species of fir, pine or pinaster, which grows wild on the Alps; a circumstance which renders it probable that it would thrive to advantage on the bleak, barren, and mountainous tracts of this country.

The timber of this tree is frequently large, and has many uses, especially within doors, or under cover. The branches resemble those of the pitch-trees, commonly called the spruce-fir: but the cones are more round in the middle, being of a purplish colour shaded with black. The bark of the trunk, or bole of the tree, is not reddish like the bark of the pine, but of a whitish cast like that of the fir. The husk, or sort of shell, which incloses the kernels, is easily cracked, and the kernels are covered with a brown skin, which peels off; they are about as large as a common pea, triangular like buck-wheat, and white and soft as a blanched almond; of an oily agreeable taste, but leaving in the mouth that small degree of asperity which is peculiar to wild fruits, and is not unpleasant. These kernels sometimes make a part in a Swiss dessert; they supply the place of mushroom-buttons in ragouts: and are also recommended in consumptive cases.

Wainscoting, flooring, and other joiner's work, may be made with the planks of aphernousli, which is a wood of a finer grain, and more beautifully variegated than deal, and the smell is more agreeable. The aphernousli is a tree of a healthy, vigorous growth, and will bear removing when it is young, even in dry warm weather. From this tree is extracted a white odoriferous resin. The wood also makes excellent firing in stoves, ovens, and kilns; but is

dangerous to be used on the hearth or in grates, being apt to splinter and fly to a considerable distance. It bears some resemblance to the white Canada pine, which is better known by the name of Weymouth-pine. See *Fir* and *Pine*.

APHIS, a sort of small insect, which is also known by the title of the puceron, or vine-fretter, and is highly destructive to different kinds of fruit-trees, especially the peach and nectarine. Dr. Darwin concludes, from the observations of Swammerdam, Bonnet, Dr. Richardson, and other philosophers, that this extraordinary insect rises in the spring from eggs, which are said to be attached by the parent aphis to the twigs of trees in the autumn, and are believed to produce not a larva or caterpillar, but a progeny similar to the parent; every one of which produces, in about ten days, not an egg, but another living progeny, to the ninth generation, without being connected amatorially with each other. The ninth generation produces males and females, some of both kinds with wings, and others without them; and this tenth generation, from those which were hatched from eggs, become amatorially connected, and produce eggs; which are laid on the new twigs of various trees, for the next year's progeny, to be hatched by the vernal sun. In this uncommon circumstance, the eggs of the aphis resemble the seeds of plants; which first produce some successive generations of leaf-buds, which are a viviparous progeny, before they again produce seeds, which are their oviparous progeny. Nor is this to be ascribed to what has been termed equivocal generation, or to an impregnation of nine fetuses inclosed within each other, as some have supposed. But this central production of the viviparous progeny of the aphis, seems to resemble the lateral production of a viviparous progeny from the polypus, which in time detach themselves from their parents; like the buds of the polygonum viviparum, or the bulbs of the magical onion (allium magicum), which are produced from the flower-cup instead of seeds, and in time detach themselves, and fall on the ground. So that these aphises are not, he supposes, to be esteemed fecundated females, but proliferous males.

This double mode of reproduction, so exactly resembling the buds and seeds of trees, accounts for the wonderful increase of this insect, which, according to Dr. Richardson, consists of ten generations, and of fifty at an average in each generation; so that the sum of fifty, multiplied by fifty, and that product again multiplied by fifty-nine times, would give the product of one egg only in countless millions; to which must be added the innumerable eggs laid by the tenth generation for the renovation of their progeny in the ensuing spring.

Their punctures of the leaves of peach and nectarine trees in the vernal months; and of cherry, plum, and currant-trees in the summer, produce a swelling and elevation of the cuticle of the leaf on its upper side, and consequent curling of it with its upper surface outwards, which terminates in a destruction of it, to the great injury of the tree, and frequently to the death of it; while the leaves of nut-trees appear to be but little injured by them, though fifty or a hundred of these insects were seen under every leaf about midsummer, both before and after they had been covered with a honey-dew.

From Dr. Richardson's account, the aphises on the rose-tree appeared in February, when the weather happened to be warm, from small black oval eggs, which were deposited on the last year's shoots in autumn; and, when the weather became colder, great numbers of them perished, by which circumstance the rose-trees are in some years almost freed from them.

They came to their full growth before April, and, after having twice cast off their exuviæ, every one of them produced about fifty young ones; all of which came into the world backwards, and adhered some time to the vent of the parent by their mouths or fore-part, and were at length set down on some tender shoots of the plant, and came to maturity in about ten days, casting off their coats two, three, or four times. They are shown in a magnified state in *plate* I, in which *fig*. 6. represents the aphis of the rose-tree without wings, very much magnified, copied from M. Bonnet, with its antennæ before, and its two horns behind, which are not half the length of the antennæ, are immoveable, and said by him to be hollow canals, from which the sweet juice called honey-dew is evacuated; lastly, with the trunk under its head in the position in which it penetrates the leaves. In some, the horns behind are wanting, and little knobs supply their place, which Reaumur thinks supply the same sweet juice. It is agreed, by all observers, that some possessing wings, and others not, does not distinguish the sexes. And *fig*. 7. represents a magnified aphis of a pear-tree, from which a young one is suspended for some time after it is otherwise born.

The ninth generation, in October, consisted of males as well as females, which were seen to cohabit; and the eggs produced by their intercourse, he asserts, were deposited generally near the new buds, or on other parts of the twigs of the trees, which they possessed. These were at first green, but in a few days became brown, and by degrees quite black. They were of regular oval figures, about one-tenth of an inch in length, and about half as broad, and adhered firmly by means of something glutinous, and resisted the severity of the winter.

Other insects, which are produced from eggs, and become winged butterflies or moths, live for some time in the intermediate state of caterpillars or larvæ. During this state of their existence, they feed on the leaves on which they are hatched, or on fruits or kernels; but after they have acquired wings and organs of reproduction, some of them take no food, as the silk-worm; and others live only upon honey, as bees, and moths, and butterflies. But the aphis, Dr. Darwin supposes, has no intermediate state between the egg and the fly, and therefore makes no holes in the leaves by eating them; or if any of them previously exist in a caterpillar or larva state, it can be only those which are produced from eggs in the early spring; which is worthy of future attention.

Whence he imagines that this fly lives not by consuming the foliage of the plants which it inhabits, but by piercing the pulmonary vessels in their natural state, or the lymphatic vessels of the leaf in their

retrograde state, by a fine tube or proboscis, which it possesses, and which it may be seen, by a common lens, perpetually to employ; as shown under its chin in the magnified insect at *figure* 6 of *plate* I. For the sap-juice, or vegetable chyle, is brought from the radicles of each leaf-bud, and propelled up the long caudex to the pulmonary artery of the leaf, where it becomes oxygenated, and converted into vegetable food; and may thus be extracted by the tubes of these insects before its sanguification.

Perhaps, he says, those aphises, which were from eggs, might eat some part of the peach-leaves during their larva state, if such exists, and occasion them to curl up;—while those which were a viviparous progeny might only pierce the sap-vessels, or blood-vessels, and thus not apparently injure the leaves; as on the nut-trees, where perhaps they were not hatched from eggs, but might have come thither in their winged state, and have then produced their innumerable viviparous offspring; as on the nut-trees he could not discern the eggs from which they were hatched; and a few larger aphises, with wings, appeared early in the season amongst the smaller ones, without wings. On these grounds he makes many curious and interesting conclusions respecting the nature and œconomy of this destructive insect.

It is further remarked by the above author, that the means of destroying an insect so extensively injurious not only to gardens and hot-houses, but to half the vegetable world, would be indeed a valuable discovery. If the eggs exist on the young buds, as Dr. Richardson affirms, some application to these before they are hatched, which might dissolve their shells, as by very dilute marine acid injected on them; or by some adhesive material, which might inviscate them as soon as they are hatched, whether they appear first in their larva state, like minute caterpillars, or in the form of the parent aphis, as soap-suds injected on the twigs before the leaves begin to unfold; or perhaps by rubbing them with oil or glue by means of a sponge, or a painter's brush: but experiments alone can determine the effect of these applications, both on the insect and on the tree.

Lime-water alone will not readily destroy the aphis, as he observed, by immersing leaves with aphises on them; which crept up the leaves, and thus escaped. But he remarks, that if pot-ash or fixed alkali be mixed with lime, the solution becomes so caustic as to destroy many insects without injuring the foliage of trees, or the stems of wheat, if we may credit M. Socoloff, who, in the Transactions of an Academy at Petersburgh, vol. v. asserts, that he added three parts of quick-lime, newly made, to two parts of a saturated solution of fixed alkali in water; which, poured on the ground, destroyed the earth-worms, and, sprinkled on the leaves of trees, destroyed the caterpillars, but did not injure, or much injure, the foliage of trees, or the leaves of wheat-plants.

Tar-water has lately been said to destroy slugs, white snails without shells, and might be worthy a trial by injecting it on trees at first with caution, lest it should injure them; as it is probably the vegetable acid chiefly, with a small portion of essential oil, which is dissolved, or mixed with the water, by agitation.

Previous to the pullulation of the buds, it is also believed to be of great service to water wall-trees with lime-water, or with soap-suds, or perhaps with the addition of some pot-ash to either of them to make a more caustic ley, such as is recommended for steeping seed-wheat; but this with caution, as he has known a solution of hepar sulphuris kill the branches of a tree which were moistened with it, as well as the insects which were upon it. Nor is he certain that this will answer the purpose, from the observations he has heard from those who have tried it.

The essential oils are all deleterious to certain insects, and hence their use in the vegetable œconomy, being produced in flowers or leaves, to protect them from the depredations of their voracious enemies. One of the essential oils, that of turpentine, is recommended by M. de Thosse for the purpose of destroying insects which infect both vegetables and animals. Having observed that the trees were attacked by multitudes of small insects of different colours (pucins ou pucerons), which injured their young branches, he destroyed them all in the following manner: He put into a bowl a few handfuls of earth, on which he poured a small quantity of oil of turpentine; he then beat the whole together with a spatula, pouring on it water till it became of the consistence of soup; with this mixture he moistened the ends of the branches, and both the insects and their eggs were destroyed, and other insects kept aloof by the scent of the turpentine. He adds, that he destroyed the fleas of his puppies by once bathing them in warm water, impregnated with oil of turpentine, as may be seen more fully in Mem. d'Agriculture, An. 1787, Printemp. p. 109.

Dr. Darwin sprinkled some oil of turpentine, by means of a brush, on some branches of a nectarine-tree, which was covered with the aphis; but it killed both the insect and the branches. A solution of arsenic, much diluted, did the same. Might not the scent of turpentine, or of tar, smeared on a fruit-wall, deter the flies from approaching the trees to deposit their eggs? or might not arsenic mixed with honey, smeared on the wall to which the trees are nailed, be likely to attract the aphis as well as other kinds of flying insects? But none of these should be smeared on the branches, lest it injure or destroy the tree. Perhaps if a few twigs smeared with turpentine, mixed with a little oil of turpentine, to make it more fluid, and to increase its odour, were fixed in quince-trees, or in apple-trees, the flowers of which are liable to be destroyed by the eggs deposited in them by a small fly, they might be deterred from approaching the tree, as the great use of essential oils, which cause the fragrance of flowers, seems to be to deter insects from infesting their leaves, or preying upon their honey.

It is probable, the doctor thinks, that if infusions were made in hot water, or perhaps for a longer time in cold water, of those leaves which no insects devour, as of the walnut, juglans; lauro cerasus, laurel; fox-glove, digitalis; henbane, hyoscyamus; hounds-tongue, cynoglossum; rag-wort, senecio jacobæa;

or of tobacco, nicotiana; and many others; and were sprinkled on the curled leaves of wall-trees, or on the buds before they open, by a pump, or by a brush or sponge, they might destroy the insects without injuring the trees; which might be determined by a few experiments.

The dust of tobacco is frequently spread on affected leaves, but not, he believes, with very encouraging success, owing perhaps to the powder not being very fine, or not soon enough applied. Some kinds of lime strewed on in powder, might probably be too caustic, and destroy the leaf along with the insects; which also might be subjected to experiment. The powder of sulphur, or of tobacco, or of any of the poisonous leaves above-mentioned, might be injected upon affected trees by a powder-puff, such as hair-dressers use; or the smoke of tobacco, or of any other of the poisonous leaves above-mentioned, might be forcibly blown on them by an adapted pair of bellows, as the smoke of many of them may possess as poisonous a quality as that of tobacco; and even the steam of a decoction of others, as of lauro-cerasus and walnut, the poison of the former of which is known to rise in distillation, might probably be used with effect: but this must depend on the greater or less fixity of their essential oils. The smoke or steam might be applied to wall-trees by previously suspending over them a large sheet of matting, or of linen, or of paper, or an old carpet; but may however be used with greater advantage in hot-houses than in the open air.

Since the above was written, the doctor observes, he has directed, in the early spring of this year, one nectarine-tree to be moistened with tar-water, and parts of the wall to be smeared with tar; another to be moistened with lime and pot-ash dissolved in water; a third with soap-suds and lime added to them; and many, both nectarine and peach-trees, with soap-suds alone. This was done by means of a brush, before any flowers appeared, and was repeated thrice on different days; but to his great disappointment, when the leaves appeared, they became affected with the aphis as on former years. He also afterwards dipped many nut-leaves crowded with the aphis in a strong infusion of tobacco, for a few minutes, as the leaves hung on the trees, without, as he believed, destroying the insects; though some of them appeared for a time to be rendered torpid.

Nevertheless, on covering a low nut-tree with some sheets of brown paper sewed together, and throwing the smoke of tobacco under it from a proper pair of bellows, great numbers of aphises were killed, many of which dropped from the upper leaves on those below them, and many adhered motionless to the under surfaces of the leaves. The fine powder of tobacco, called Scotch snuff, sprinkled on the aphises by turning up some of the leaves, quickly destroyed them.

As walnut-leaves may be had in great quantity in the autumn, and the whole plant of senecio jacobæa, rag-wort, at any time, (both which are probably deleterious to insects, as they seem never to be injured by them,) these might be procured at small expense, and might probably, when dried and burnt, produce a smoke equally destructive to them. But the most ingenious manner of destroying the aphis would be, he thinks, by the propagation of its greatest enemy, the larva of the aphidivorous fly; which is said, by Reaumur, tom. iii. mem. 9. to deposit its eggs where the aphis abounds, and that, as soon as the larvæ are produced, they devour hundreds around them with the necessity of no other movements but by turning to the right or left, arresting the aphis and sucking its juices. If these eggs could be collected and carefully preserved during the winter, and properly disposed on nectarine and peach-trees in the early spring, or protected from injury in hot-houses, it is probable that this plague of the aphis might be counteracted by the natural means of devouring one insect by another; as the serpent of Moses devoured those of the magicians.

APHIDIVOROUS *Fly* or *Larva*, a fly or insect, which is found to destroy the aphis. The following description of it is given by Dr. Darwin, in his Phytologia, as communicated by Mr. Swanwick, of Derby:

"On August the 4th, 1799, Mr. Horrocks obligingly sent me an aphidivorous larva in a box on a leaf of a plum-tree, on which were a number of aphises; and I had almost immediately the pleasure of seeing it eat one.

"The method of taking his prey, is thus: He is like the sloth in his disposition, for he does not ramble about while he has food around him. He only lifts up his head, and strikes it down again, extending it in various directions, as if he was blind, and repeating the above action. If, by so doing, he happens to feel an aphis, he immediately seises it by the back, lifts it up, and poises it in the air, as if to prevent it from liberating itself by its struggles against the surface of the leaf, or that it may fall more easily into the cavity of his mouth. In this position he holds it, while he pierces it, and sucks the juice out of the body; which having done, he drops the skin, licks his lips round with his little black tongue, contracts his head, and drops it down; thus resting in perfect repose for some time; after which, he repeats the same actions. But if he is in the midst of plenty, he seldom gives himself this trouble, but waits till an aphis touches him, when he immediately turns his head round, and with fatal certainty seises him, poising him as before.

"For the purpose of seeing what fly was produced from this caterpillar, I procured him food for about ten days. During this time he ate a great number of aphises, and grew to about an inch in length; when he left off eating, contracted himself to about half his former length, fixed himself to the box by a little gluten, which he discharged from his mouth, and, without casting a skin, changed to a chrysalis.

"In this state he lay about ten or eleven days, at the end of which time he burst his cell, and came out a beautiful fly. *Fig.* 8, *plate* 1, represents the aphidivorous larva, with an aphis in its mouth; and the chrysalis of the same insect, before it is transformed into the fly, at *fig.* 9. These, Dr. Darwin observes, were all drawn from nature, and exactly resemble similar representations in the work of Bonnet."

APHIS-LION, an insect so denominated by Bonnet, from its greedily devouring aphises. It is re-

presented in *plate* I. *fig.* 10, and as transformed into the fly state at *fig.* 11.

APIARY, a bee-garden, or place where bees are kept. As a general rule, hives should be placed in such situations as are little exposed to the wind, and enjoy as much of the influence of the sun as possible; as wind always retards the bees in their work, while the sun's beams invite them to it. And although it be well known, that bees will thrive well in high and windy situations, a low one is always to be preferred. In the vicinity of the apiary, there should also be abundance of flowers, from which the bees may collect their wax and honey. Mr. Bonner observes, that were a choice allowed him where to place his bees, it would be in an early situation,—a hollow glen by the side of a rivulet, surrounded with abundance of turnips in blossom, in the spring,—mustard and clover in summer,—and heath in the latter end of summer and harvest; with a variety of other garden and wild flowers in their seasons. However, says he, it is not to be understood from this, that bees will not thrive unless they are placed in such an advantageous situation, as the contrary can be proved: for bees have thriven amazingly well in places where they were not within reach of many of the above-mentioned flowers; but although they will do well in most situations, and fly far for food, yet they will thrive far better when situated among or near good pasture, and surrounded with abundance of food. And Mr. Keys remarks, that the hives should be clear from the droppings of trees, and the annoyance of dung-hills, long grass and weeds, as by these, insects are bred, which are destructive to the bees and their productions. See *Bees.*

APIS, a term sometimes applied to the bee. See *Bees.*

APOPLEXY, in *farriery*, is a disease which is often called the *staggers*, to which horses and other animals are subject, and by which they drop down suddenly, without sense or motion, except a working of the flanks.

The symptoms and appearances which precede and point out the approach of this disease, are drowsiness, watery moist eyes, somewhat full and inflamed, a disposition to reel, feebleness, a bad appetite, and almost a continual hanging down of the head, or resting it upon the manger, frequently with little or no fever, and scarcely any alteration in the dung or urine. When the disease proceeds from water collected in the sinuses or ventricles of the brain, besides the above symptoms, there is generally a disposition to rear up, when handled about the head. Young horses are most subject to this complaint, which is not always suddenly mortal, as, with proper helps and good usage, they sometimes get over it. If, however, the disorder proceeds from wounds or blows on the head, or from any other cause producing ruptures of the blood-vessels, or from matter collected in the brain, or its membranes; or if any part of the brain or its membranes be indurated, or grown callous, the horses will not only have most of the symptoms already described, but be frantic, especially after their feeds, so as to start and fly into motion at every thing that comes near them. These cases are extremely dangerous, and seldom admit of perfect recovery. And when horses fall down suddenly, and work violently in their flanks, without ability to rise, even after plentiful bleeding, they seldom recover. In such cases, all that can be done is, to strike the veins in several places at once, to raise up the horse's head and shoulders, propping them with plenty of straw; and if he survives the fit, to cut several rowels: however, in cases of ruptured vessels, or extraneous matter being lodged in the brain or its membranes, these means will be but of little service.

Where apoplectic fits happen to be only the effect of a fulness of blood, from high feeding, and want of sufficient exercise; or the effect of a sizy blood, which is often the case of young horses, that have been fed for sale, or from catching cold while the blood is in this state, the cure will not be attended with any great difficulty, notwithstanding a horse, in these circumstances, may reel and stagger, and sometimes fall down suddenly.

In this disorder full bleeding should first of all be had recourse to, and the horse kept for some time to an opening diet of scalded bran, and sometimes scalded barley, lessening the quantity of his hay; and after a day or two, the bleeding may be repeated, but in a smaller degree. If the horse has a cold, it may also be proper to give him pectoral drinks. But if no symptom of a cold appear after bleeding and a spare diet, two or three purges may be requisite, in order to prevent the danger of a relapse, such as the following:

"Take of the finest Soccotrine aloes, an ounce and a quarter; fresh jalap, two drams; salt of tartar, three drams; cinnabar of antimony, half an ounce; make them into a ball with a sufficient quantity of syrup of roses or marsh-mallows; adding twenty or thirty drops of the oil of aniseeds, rolling it in liquorice-powder." This purge may be made stronger or weaker, according to the circumstances of the case, by increasing or diminishing the quantity of jalap, and may be repeated two or three times if necessary. Exercise should not be omitted as soon as the horse is able to bear it. When horses drop down suddenly with hard riding or violent driving, the complaint in many respects resembles apoplexy, the organs of the head being affected in the same way as in that disorder: but as, in this case, the disease proceeds only from the extraordinary rarefaction of the blood, and its rapid motion, whereby the small vessels of the brain, heart, and lungs, are so distended as to cause great pressure on the origin of the nerves—the horses by this means lose all sense and motion, and generally fall suddenly, especially upon any sudden stop; as, when the bodily motion ceases, the circulation of the blood in the veins not being accelerated in proportion to the quickness of its influx from the arteries, an accumulation takes place in the brain, in consequence of which the horses fall down without sense or motion. Instances of this kind are not uncommon, especially in very hot weather, as the external heat adds greatly to the blood's motion and rarefaction. In these cases the quickest and safest remedy is bleeding, when the horses do not die from the violence of the fall, which sometimes happens, or by the bursting of the vessels in the brain or lungs, or from some morbid condition of the heart or large vessels. See *Staggers* and *Palsy.*

APPETITE, in *farriery*, a certain painful or uneasy sensation, accompanied with a desire to eat or drink. Horses, more than most other creatures, are subject to diseases of the stomach, particularly to *a want of appetite*, and a *vitiated or voracious appetite*.

Want of Appetite is when a horse feeds poorly, and is apt to mangle his hay, or leave it in the rack, and at the same time gathers little flesh, his dung being habitually soft, and of a pale colour.

This state of the stomach evidently arises either from some error in respect of diet and management, want of grass, or from a relaxed constitution, in which the stomach and bowels are more particularly affected with debility. This weakness of the digestive organs may be either accidental or constitutional; and it may proceed from the use of food administered in an improper state, such as too much scalded bran, or hot meat of any kind, which relaxes the tone of the stomach and bowels, and ultimately produces a weak digestion, and consequently a loss of appetite.

The best method to strengthen and recover horses in this state is to give them gentle exercise in the open air, especially in dry weather; never to load their stomachs with large feeds; and to keep them as much as possible to a dry diet, indulging them now and then with a handful of beans among their oats.

But where the disorder has been caused by over-feeding with dry food, and the neglect of proper evacuation and exercise, mashes with gentle saline purges, would seem to be the most suitable remedies; and where horses do not gain strength under the above management, a run at grass will most probably be the readiest method of removing their complaints; the following mild purges and drinks being given on their return, according to the circumstances of the cases:

"Take Soccotrine aloes, six drams; rhubarb, in fine powder, two drams; tincture of aloes, two drams; saffron, dried and powdered, one dram; syrup of roses, a sufficient quantity.—Make it into a stiff ball with treacle."

This purge generally operates very gently, strengthens the digestion, and brings the horses to a better appetite. It may be repeated once a week, or once in ten days.—After the operation of each purge, the following drink may be given:

"Take of the raspings or shavings of guaiacum, a large handful; of pomegranate bark, and balaustines bruised, each an ounce; galangals and liquorice-root sliced, each half an ounce. Let these be boiled, in six quarts of smith's forge-water, to three pints; and, while it is warm, infuse in the decoction two drams of saffron, and half an ounce of diascordium."

The clear liquor may then be divided into two drinks, one of which must be given after the purge has done working, and the other after two day's intermission. In cold weather the drinks should be warmed before they are administered. Horses, during this course, should be constantly exercised in the open air.

Where such a state of the stomach takes place from the excessive feeding of young horses kept up for sale, the best way is to bleed and purge them gently for two or three times; and, at the same time, rather increase their exercise, and lessen the quantity of their food.

As for those horses that are of a hot fiery disposition, and lose their appetites in consequence of their heat and fretting, they are cases that cannot be easily remedied: the only method is, to keep them as much as possible to a cool diet while they are young, and, in country places, to let them run abroad, especially where they have stables and warm ranges, to keep them from the inclemency of the weather in winter, as this sort of horses are always tender, being, for the most part, extremely thin-skinned. On the same account, too, the best way, in summer, is to bring them up in the day-time, and only let them run abroad in the night, as they are more liable to be hunted with the flies than others; which keeps them continually upon the fret, and hinders them from feeding and gaining flesh. When such horses live till they are full-aged, their heat and fieriness often abate, so that they grow more useful; but while they are young, they are more subject to inward imposthumations than horses of a cooler temperament; and these often kill them suddenly, or bring them into lingering maladies, which in some measure may be prevented by the means we have just recommended. Some have likewise recommended the use of chalybeates, such as infusions of steel-filings in strong ale, with aromatics and bitters.

Vitiated Appetite is that where the animal is incessantly craving for meat, and eats all sorts of trash that he can meet with in the place where he is kept.

This state of the digestive organs, in horses, for the most part proceeds from indigestion, and acidity in the stomach and bowels, which probably depends upon some local debility of these parts; or it may arise from such matters as have a tendency, by their unnatural stimulus, to increase the desire of food, as the eating of foul litter, dirt, and other similar substances.

The most proper means of removing the complaint would appear to be the administering of gentle purges in the first instance, and afterwards having recourse to absorbent remedies, such as magnesia and salt of tartar, as well as strengthening drinks, such as have been prescribed above. Where the bowels are too loose, chalk, with the extract of logwood, and gum arabic, may be given to great advantage.

The stalls, where horses affected with this complaint are kept, should always be clean, and have fresh litter in them, as, where this is attended to, little injury can be done by their eating the litter from under them.

APPLE, an orchard-fruit, cultivated by the farmer for the purpose of cider. See *Orchard*.

The varieties of this useful fruit in the cider-districts are exceedingly numerous. In Herefordshire, Mr. Marshall observes, a very considerable proportion of the fruit which is grown is "kernel-fruit," produced from trees that have been raised from the seed, and which have never been grafted; consequently each tree is a separate variety of apple, bearing the name, perhaps, of its planter, or of the "ground" it grows upon.

There are, nevertheless, numbers which are univer-

-fully known; and some of them sufficiently celebrated to be entitled to notice.

The *stire-apple*, for the most part, stands first in estimation. The fruit of this variety is somewhat below the middle size. The form rather flat. The colour a pale yellowish white, with sometimes a faint blush on one side. The flesh tolerably firm. The flavour, when fully ripe, fine. It is deemed, by most people, a tolerably good-eating apple. The cider which is produced from it, in a soil that is adapted to it, is rich, highly flavoured, and of a good body: its price frequently four-fold that of common sale cider. The thin lime-stone soils, on the margin of the forest of Dean, are said to produce the richest stire-cider. The tree which bears this apple is of a singular growth,—remarkably "becsom-headed,"—throwing out numerous, straight, luxuriant, upward shoots, from the crown; taking the form of a willow-pollard; running much to wood; and, in deep soils, growing to a great size before it becomes fruitful.

There is an apple called the *red stire;* but it has no peculiar affinity with the true stire. In Herefordshire, about Marcle, the "yellow stire" is met with; and on the forest there is the "kernel stire;" both of them probably kernel-fruits, which, bearing some likeness of the true stire, have had its name improperly given them.

The *Hagloe crab* has commonly been held next in esteem; and it may be remarked that this variety is traceable to the original seedling. It was produced, about seventy years ago, in a nursery, among other stocks raised from the seed, by Mr. Bellamy, of Hagloe, in Gloucestershire, grandfather of Mr. Bellamy near Ross in Herefordshire; who draws from it (that is, from trees grafted with scions from this parent stock) a liquor, which, for richness and flavour, probably exceeds most other fruit liquors. He has sometimes been offered sixty guineas for a hogshead (about 110 gallons) of it. He has likewise been offered, in exchange, bottle for bottle of wine or spirituous liquors, the best to be produced; and without the expense of freight, duty, or carriage.

This fruit, while growing, is nearly white; when fully ripe it has a yellowish cast; sometimes freckled with red on one side, like the common white crab. The size about that of the stire-apple; but the form more oblong. The flesh remarkably soft and woolly, but not dry, being furnished with a sheer, but, when fully ripe, sweet juice; which, however, is much smaller in proportion to the quantity of fibrous matter than that of most other apples. The flavour, when ripe, resembles that of cashew-apple of the West-Indies; and, what is remarkable, the texture of the flesh is not very dissimilar to the pulp of that fruit. The cider, notwithstanding the sheerness of the juice, is, when properly manufactured, singularly rich; and, notwithstanding the faint smell of the apple, is highly flavoured: and, what is equally remarkable, the liquor is of the highest colour, notwithstanding the paleness of the fruit.

The *golden-pippin* has likewise been in high estimation as a cider-apple, and been ranked as the third of this district. It is more generally known than the Hagloe crab; and, at market, its liquor is generally next in price to that of the stire-apple.

The *old red-streak* is yet in being. The fruit small, roundish, of a pale yellow ground, with numerous faint red streaks. The flesh firm, full of juice, and, when ripe, finely flavoured: a palatable eating apple. The cider made from it is not in particular estimation, little, if any, genuine liquors being indeed prepared from it. It probably never was equal to that of either of the preceding apples. The tree which produces this apple is of a singularly awkward growth; crooked, reclining, ragged, and unsightly.

The *woodcock* is another favourite old cider-fruit, but is now going off; many old trees, however, are still left in the district. The fruit is much larger than any of the preceding sorts—above the middle size. The form somewhat oblong; with a long stalk, set on in a peculiar manner, feigned to resemble the woodcock's beak: hence the name. The colour that of the red-streak, with the addition of some dark blood-red streaks on one side. The flesh remarkably fine; equally fit for culinary purposes and for cider. The tree large, and strongly featured, forming large boughs in the pear-tree manner.

There are also other favourite cider-apples, such as the *must*, an old favourite fruit, of which three sorts are enumerated: the *pauson*, a middle or rather large sized yellowish-green apple, which makes exquisite cider, and of good colour; the *royal wilding*, a large white apple; and the *dymmock red*, a middle-sized.

The *coccagee* is above the middle size; greenish-white, with an orange blush; is well-fleshed, and highly-flavoured. The cider produced from it is held in high estimation.

Russets, of various kinds, are in good esteem, particularly the *Longney russet*.

Bromley, *fox-whelp*, *red crab*, *old quining*, all of them large red apples, have been in good estimation for cider.

Mr. Crocker, in his account of the "Art of making and managing Cider," says, that the following are among the most valuable cider-fruits of the orchardists of Herefordshire and Worcestershire:—*The Bennet apple;* streaked with red, of a pleasant taste, makes a good second-rate cider.—*Captain Nurse's kernel*; yellow; streaked with red, of a mild acid flavour; makes light pleasant cider.—*Elton's yellow:* of this apple there are two sorts, the one to be met with *above* Hereford, and the other *below*; the former of the shape and size of an orange, yellow on one side and red on the other, of a mild pleasant acid, and makes very good cider; the latter is somewhat larger, and of a beautiful gold colour, sharp to the taste, and makes excellent cider.—*Normandy apple*: under this name there are three sorts, the yellow, the white, and the green, all of a bitter-sweet taste, which make rich cider, and of a high colour. The trees are said to be most abundant bearers: Mr. Crocker has been informed by a friend, whose veracity may be depended on, that thirty trees of this sort, in the fifth year after grafting, produced five hogsheads of cider, of one hundred and ten gallons each.—*Yellow or Forest*

styre: small, red on one side, and a fine yellow on the other, of a mild pleasant acid, and, in the opinion of many, makes the most excellent cider; the tree, however, seldom thrives well, and is but a shy bearer.

Somersetshire, he likewise observes, produces a great variety of cider-apples, of which the following ought to be held in the highest estimation:—*The Jersey:* small, of a light red ground, with a variety of lake-coloured streaks, moderately bitter; makes high-coloured cider, which is sluggish in its fermentation, and particularly ought to be made by itself.—*White-Sour:* small, of a yellow ground, lightly tinged towards the nose with a light brown, and some strong touches of brown near the stem; of an acid flavour, somewhat acrid, very juicy; and makes smart palatable cider.—*Margill:* middle-sized; yellow, lightly tinged with red; pleasant flavour; is a fine cider-fruit.—*Vallis apple:* large and handsome, finely tinged with red all over, sweet in its flavour, very juicy; makes tolerable cider.—*Barn's-door:* moderate size, brown towards the stem, the rest part red, some red streaks within, late in ripening, a pleasant acid; makes very good cider.—*Crab red-streak:* small, greenish-yellow on one side, light red on the other, with strong red streaks; of a pungent acid; and, under proper management, makes smart stout cider.—*Du-ann:* small, yellow near the stem, strongly tinged with red towards the nose, smart acid; makes good cider.—*Jack Every:* middle size, light yellow tinged with brown and red, sweet flavour; makes tolerable cider.—*Coccagee:* yellow, spotted with red and brown, of a rough acrid flavour; makes very smart cider under due management; but, its fermentation being particularly volatile, it requires much attention soon after making.—*Clark's primo:* middle size, of an orange colour on one side, red blotched with brown on the other, of a mild luscious acid; makes rich cider, and is also an excellent apple for the table.—*Buckland:* small, yellow-tinged with red, veined with red within; makes good cider.—*Pit-crab:* small, dark-red finely tinged with a lake colour within, smart acid; makes good cider.—*Slatter's Pearmain:* middle size, yellow richly tinged with red and brown, delicious flavour, firm flesh; makes excellent cider; but hitherto has been more used at the table than at the press.—*Slatter's No.* 19: long in its form, ground a yellow and light red, finely blotched with strong red, moderately acrid; is a fine cider-fruit.—*Slatter's No.* 20: yellowish ground tinged with red, smart acid flavour; makes very good cider.—*Slatter's No.* 21: tinged on the sun-side with red and brown, very pleasant flavour, and will undoubtedly be esteemed as one of our best cider-apples. The four last-named apples, the author says, are new, the trees being lately raised from kernels by Mr. Slatter, of Ilminster, Somerset, whose orchards and cider have long acquired much celebrity.—*Castle-pippin:* greenish yellow, veined with brown and slightly tinged with red, mild acid, and makes good second-rate pale cider.—*Saw-pit:* red throughout, acid flavour, and by some is esteemed the best cider-apple in the country.—*Pomme apis:* large, yellow, faintly tinged with red on the sun-side, broad at the stem, very juicy, smart but pleasant acid; is undoubtedly a fine cider-fruit: it is, however, very little known in this country, having been brought from France but a few years since, and the propagation of it being confined to one or two nurseries only.

Devonshire also possesses many very valuable species of cider-apples, from which Mr. Crocker has selected the following, as being the most valuable:—*Staverton red-streak:* whitish yellow at the stem, brown tinged with red towards the upper end, pungent acid; makes a smart but pale-coloured cider: the tree a remarkably plentiful bearer.—*Sweet broady:* large and handsome, colour brown and red; makes good cider, useful for mellowing that of the very acid fruits: the tree large and fine, and bears plentifully.—*Lemon bitter-sweet:* yellow rind, hard and firm, a pleasant bitter, and is by some esteemed a fine cider-apple.—*Josey:* a handsome yellow, subject to spots of brown on the rind, of a mild acid taste, very soon after gathering perfects the saccharine fermentation; makes mild pleasant cider, but not lasting: it is also a good table-fruit.—*Orcheton pippin:* a very handsome apple, yellow on one side and red on the other, of a highly pleasant flavour, excellent for cider, the table, and the kitchen; in point of general utility, perhaps, few apples are superior.—*Wine apple:* greenish-yellow ground, very thickly streaked with red all over, pulp a little red, mild acid; is a very good cider-fruit.—*Marygold spice-apple:* yellow ground, light brown about the stem, highly and beautifully tinged with pink, mild acid, of a spicy relish; makes excellent cider of a delicious flavour: it is a delicate fruit also for the table, and keeps long.—*Ludbrook red-streak:* yellow ground finely tinged with pink, smart acid, and makes excellent cider: the tree subject to canker.—*Green Cornish:* yellow with green ground lightly tinged with red, of a mild acid flavour, early ripe, and makes good cider.—*Butter-box:* yellowish-green tinged with light red, mild acid; makes pleasant, but not lasting, cider.—*Red Cornish:* red nearly all over, of a mild acid; makes good cider.—*Broad-nosed pippin:* large, rich yellow, mild acid; makes pleasant, but not strong, cider.—*Cat's-head:* large, greenish-yellow, pleasant acid; makes good cider.—*Brandy apple:* middling size, white, smart acid; makes pale-coloured frisky cider.—*Pine's red-streak:* very handsome, red all over except at the stem, flavour not so smart as the *Ludbrook*, but makes a cider equally good.—*Winter-red:* dark red with some tinges of brown at the stem, crisp in its pulp, very juicy, of a smart spicy flavour, will keep until April, and is excellent both for cider and the table.—*Sweet pomme-roi:* yellowish green on the shade-side, and brown tinged with red on the sun-side, of a luscious flavour; is deemed a good cider-apple.—*Bickley red-streak:* a late fruit, greenish and yellow finely tinged with red, pulp firm, flavour somewhat acrid; is a most excellent cider-apple.

It is further remarked, that although the sorts of apples above described deserve particular commendation as cider-fruit, yet there are many others, in each of the cider-counties, from which, under due management, not only tolerable but good cider may be

made; but from the foregoing catalogue any nurseryman may find ample choice to propagate from in future.

It cannot but be observed, he thinks, that names are given to apples arbitrarily, and which are by no means fully expressive of their qualities; but if there be a general characteristic of good cider-fruit, it seems, says he, to be this—that the apple which is of a yellow or light red ground, tinged with red streaks on the sun-side, of a smart acid flavour, with firm but juicy parenchyma, and of an aromatic flavour, be it called by what name it may, will, without doubt, make good cider.

The fourth volume of the Letters and Papers of the Bath and West-of-England Agricultural Society, has a letter from Mr. Gullet, of Exeter, which recommends the following method of destroying the insect that prevents the blossoms of apples and some other fruit-trees from producing fruit. These insects are supposed to be deposited in their egg-state, by a fly, in the bud or blossom of the apple, at its first opening, and soon to become maggots, which exhaust the nourishment of the blossom, and which, with the slightest touch, will fall off. It is to set fire to some heaps of wet straw, weeds, or any matter of the same kind, on the windward side of the garden or orchard, so that the smoke from the heaps may blow through the trees for some days. The expense attending will be very trifling, considering the beneficial effects of it, as it will not only destroy the insects that are formed, but prevent them from depositing their eggs. Dr. Darwin asserts, that the early blossoms of apple and many other trees are frequently destroyed by an excess of cold; and Mr. Knight remarks, that that haziness of the air which usually accompanies warm days and frosty nights, with a north-east wind, in the spring, is injurious to the blossom of every tree, and particularly so to that of the apple; for the warmth of the day hatches the eggs of the insect which breeds in it, whilst the coldness of the night, by checking the progress of the sap, retains the blossom in its half-expanded state to form a nidus for it. This insect, which assumes the winged state in July, is, he says, a small brown beetle, and that it then probably lays those eggs on the trees, which, if the succeeding season be unfavourable, prove destructive of the future crop of fruit.

The leaves and blossoms of the apple-tree are also sometimes, he observes, entirely destroyed by a numerous tribe of caterpillars, some kinds of which become moths in the summer and autumn, and others in the succeeding spring. These, however, do not, in any exclusive degree, belong to the apple-tree, being found on many other trees; but there is, he tells us, an extremely minute insect, of the cochineal tribe, which has lately appeared on the apple-trees near London, and has done incredible damage to them. Small downy spots appear on the stems and branches of the trees, each of which covers a multitude of these insects, which are attached to the bark by their suckers, and fed by its juices. The trees on which they abound appear like tender exotics, the points of whose branches have been killed by the preceding winter. He is informed by Sir Joseph Banks, that these insects were first observed in the neighbourhood of Kennington, in 1788, and that they were said to have been imported from France; but he could not obtain any information from his correspondents in that country of their existence there. They have since gradually extended themselves round the centre where they first appeared, and no means of destroying them have been yet discovered. Mr. Knight advises that apple-trees should not on any account be brought into the cider-counties from any neighbourhood where these insects are suspected to exist, and that every precaution should be taken to prevent their introduction. It is, he adds, the opinion of the most experienced nurserymen round London, that all the apple-trees in that neighbourhood will be destroyed in a few years, if the insects continue to increase as rapidly as they have lately done.

The blossoms of the apple appear also, he thinks, to fail not unfrequently from the want of impregnation, when the weather is unusually hot and dry, or when cold winds prevail; for he has often observed the farina to wither and die on the antheræ in such seasons. In each of these cases he has always seen those trees most productive, which, having had the good fortune to escape the desolating hand of the pruner, were moderately full of wood, and capable of affording their blossoms some protection from frost and cold winds, or excessive heat. It has been suggested by Mr. Knight, that the inspissated juice of the apple and pear may be found highly serviceable in long voyages, as it keeps well under different changes of climate, and only occupies a little space.

The apple is constituted, according to Dr. Grew, of four different parts; namely, the *cuticle*, the *parenchyma*, the *branchery*, and the *core*.

Apples and pears should be gathered from the trees about October, when in a perfectly dry condition, and be laid in a dry situation thinly upon proper shelves. An arched vault is recommended by some.

Apple-tree, in rural œconomy, the tree which produces the fruit described in the preceding article. Trees of this kind are found in general to thrive well when planted on strong deep loamy soils, or such clayey ones as, by having a portion of gravel in their composition, are renderd not retentive of water. Mr. Knight, in his Treatise on the Culture of the Apple and Pear, remarks, that the fruit-liquors, for which the county of Hereford has long been celebrated, have always been supposed to derive their excellence from some peculiar quality in the soil which produces them; but that a preference has been given to soils of opposite kinds by the planters of different ages. Those of the last century, says he, uniformly contended in favour of a light sandy loam, and on that their finest ciders were made: at present, a soil of a diametrically opposite quality, a strong red clay, is generally preferred. Much of the soil which is called clay in Herefordshire is, however, he says, properly argillaceous marle; and some of it contains a large portion of calcareous earth, and effervesces strongly with acids. He has found this soil to form the sub-stratum of some orchards much celebrated for producing ciders of the first quality. It appears, he tells us, to have the

effect of mitigating the harshness of rough austere fruits; and that, as the trees grow with great luxuriance in it, it is, perhaps, of all soils, the best calculated to answer the wishes of the planter: but that the strongest and most highly flavoured liquor which has hitherto been obtained from the apple, is produced by a soil which differs from any of those that have been mentioned—the shallow loam, on a limestone basis; such as is met with in the forest of Dean, in the same county.

In regard to situation, Mr. Knight observes, that the apple-tree succeeds best in situations which are neither high nor remarkably low. In the former, its blossoms are frequently injured by cold winds, and in the latter by spring-frosts, particularly when the trees are planted in the lowest part of a confined valley. A south or south-east aspect is generally preferred, on account of the turbulence of the west, and the coldness of north winds; but orchards succeed well in all; and, where the violence of the west wind is broken by an intervening rise of ground, a south-west aspect will be found equal to any. Apple-trees are generally the most productive of fruit, when they are situated near the fold-yard, and in consequence much trod and manured by the cattle in the winter. The ground in which old apple-trees have grown, is esteemed very unfavourable to young ones. When, from contiguity to the house, an orchard is planted in this kind of ground, the pear and apple should be made to succeed each other, as has been judiciously recommended by Mr. Marshall.

In the choice of fruits for every situation, attention, Mr. Knight thinks, should be paid to select such as are sufficiently early to ripen well in it. A cider-apple may, he says, be safely pronounced to be too late for the situation it occupies, when it does not become yellow before the end of October: and he does not know any disadvantages attending an early maturity, provided the kinds of fruit be capable of being kept a few weeks. An opinion, he observes, prevails, that the liquors obtained from all early fruits, are without strength or body; but the strongest cider yet known, is produced by one of these, the stire. In cold and unfavourable situations, those fruits will best repay the planter, which, in their general character, appear nearly related to the native kind, or crab; for, though the flavour of these be austere and ungrateful to the palate, the ciders produced from some of them, when they have been thoroughly ripened, are often found smooth and generous. But he would recommend the grafts to be taken from an improved crab, and not from a degenerated apple; for the former will possess much of the hardiness and vigour, whilst the latter will often inherit the debility and diseases of the parent tree.

The fruit-trees of Herefordshire, the same author observes, are generally planted in quincunx, or in straight lines crossing each other at right-angles. The former method is preferred in the hop-yards and pasture, and the latter in tillage, being less inconvenient to the ploughman. But it appears to him, that any given number of trees planted near each other in rows, with wide intervals, would be less injurious, either to pasture or tillage, than in either of the preceding methods. The trees in each row should, in this case, be of the same variety of fruit, that no one, by possessing greater vigour and luxuriance, might overgrow and shade another; and that the whole row might appear a continuation of the same tree. The intervals between would afford considerable space for the plough or pasture; and every tree, having room to extend its branches on each side, would be more protected than injured by its neighbours, and would attain nearly, or quite, as large a stature as if entirely insulated. The cider-maker would also be able to collect with convenience, each kind by itself, and might afterwards mix them according to his judgment or caprice. Unless an orchard be very large, not more than five or six kinds should be planted in it; and if some of these be such as blossom early, and others late, the planter will have as good a chance of an annual supply of fruit as a larger number of kinds would afford him.

The distance between each row, as well as the space between each tree, must depend on the situation and soil. When the former is high and exposed, the trees should be closely planted, to afford each other protection; and, when the latter is poor and shallow, their growth will of course be diminished, and they will consequently require less room: but in low and sheltered situations, and deep rich soils, where the trees are little exposed to winds, and attain a large size, wider intervals must be allowed them. In the former instances, a distance of twelve yards between each row, and half as much between each tree, will be sufficient: in the latter, twenty-four yards between each row, and eight between each tree, will not be found too much, particularly if the ground is intended for tillage after the trees have grown to a considerable size. An opinion, he remarks, rather generally prevails, at present, in favour of planting single trees, at twenty or twenty-five yards distance from each other, on arable grounds; and specious reasons may be offered in defence of this practice: the roots, as well as the branches, are at perfect liberty to extend themselves in every direction; but the latter are every way exposed to the storms of autumn and to the cold winds of the spring; and trees of more hardy kinds than the apple are well known to grow much better when planted near enough to afford each other protection, than when totally insulated. It may be supposed, that trees growing in distant rows, will not regularly occupy the whole surface of the ground with their roots; but these always extend far beyond the branches, and will meet across very wide intervals. The growth of every insulated tree is more low and spreading, and consequently more injurious to corn or herbage growing under it. Where the mode of cultivation will admit, the rows should always extend from north to south, as in this direction each part of every tree will receive the most equal portions of light and heat.

Apple-trees are generally raised with most success, and at least expense, in a hop-yard; the ground under this culture being always well tilled and manured, as well as fenced against all kinds of cattle. Considerable advantages may be obtained by planting twice the number which are to remain of trees in each

row, using two kinds of fruit, and putting each alternately. The kind which succeeds best may be left, and the other be removed to the tillage. Trees of a large size may be transplanted without the least danger, in the autumn, particularly if the roots be shortened in the preceding winter. The sub-soil of the ground, which suits the hop, is not unfrequently too moist for the apple, and this defect is rarely removed by draining. Where a hop-yard is wanting, trees may be raised in tillage or pasture; but the expense of defending them properly will be considerable, particularly in the latter, in which, though ever so well defended, they usually make but a slow progress. In tillage land, the least expensive (and perhaps the best) method of raising apple-trees will be, to exclude every species of cattle, except sheep and pigs, and to defend the trees only with small branches bound round their stems, as in the broom or besom of the farm-house. This fence must begin close to the ground, and rise to a greater height than the sheep or pigs, or the chains of the horses in ploughing, can reach; and, to preserve the bottoms of the stems from injury by the plough, a strong oak stake should be driven into the ground on each side of every tree. The small branches which defend the stems, will require to be replaced every other year; but this will be done at a very trifling expense.

When a plantation is to be made in pasture-ground, timber-frames will be found necessary. The kind most in use at present are made with two flat posts, placed with their wide surfaces parallel to each other, at two feet apart, having boards nailed to their edges on each side, with small distances between them. The trees are here perfectly protected from cattle; but when their branches extend themselves, and become agitated by the wind, the stems can scarcely escape being rubbed against the frames. Another (and, Mr. Knight thinks, a much better) kind of frame is made with three posts, placed triangularly round the tree, approaching each other at the roots, and diverging considerably upwards. This appears more expensive than the other; but timber of much inferior value may be used. In this method of planting, the formality of the row may be dispensed with; but the trees will succeed much better, if three or five be planted near each other, with wide intervals, than if each stand entirely alone.

Little care is required, though more, the author observes, than is generally given in Herefordshire, in transplanting the crab-stocks or apple-trees; but, in removing from the nursery to the field, attention should be paid to leave the roots as long and as little injured as possible, and not, on any account, to bury them deeper than they formerly grew. The soil round each tree should be dug eighteen inches deep, and four or five feet wide, placing the sod, if the ground be pasture, in the bottom of the holes, as recommended by Mr. Marshall. If the holes, in this case, be made six months before the time of planting, and if a small quantity of rich mould be mixed with that of the field immediately round the roots, it will much accelerate the future growth of the trees; but it will rarely be adviseable to make use of any very delicate or highly cultivated fruits, when this method of planting is adopted. The branches of the trees, whether grafted or not, and wherever planted, should be much retrenched; and the mould may be raised a few inches round the stems, to prevent their being shaken by the wind. A stake to each will also be of much service; but great care must be taken to prevent the bark of the tree receiving injury by being rubbed by it. Wherever a plantation is to be made, the autumn is the most eligible season; but if, from any cause, the planting be delayed till spring, the trees will succeed perfectly well, if the soil or succeeding season be not remarkably dry. When the trees have once taken root in the hop-yard or tillage, they will not require any thing more than protection from the planter; but in the pasture, the ground should be annually dug three or four feet wide round each, during the first four or five years.

The apple-tree, being naturally very full of branches, frequently requires the operation of pruning; and, when properly executed, great advantages will be found to arise from it: but, Mr. Knight says, as it is generally performed in Herefordshire, the injury the tree sustains is much greater than the benefit it receives. The ignorant pruner gets into the middle of it, and lays about him to right and left, till he leaves only small tufts of branches at the extremities of the large boughs. These branches, now receiving the whole nourishment of the tree, of course increase rapidly, and soon become, when loaded with fruit or snow, too heavy for the long naked boughs, which are of necessity full of dead knots from the former labours of the pruner, to support. Many hundred trees annually perish from this cause. He believes the present system of pruning ought to be precisely reversed, and that the pruner should confine himself almost entirely to the extremities of the bearing branches, which are always too full of wood, and leave the internal part of the tree nearly as he finds it. Large branches should rarely, or never, be amputated. In the garden-culture of the apple, where the trees are retained as dwarfs or espaliers, the more vigorously growing kinds are often rendered unproductive by the excessive, though necessary, use of the pruning-knife. The author has always succeeded in making trees of this kind fruitful by digging them up, and replacing them with some fresh mould in the same situation. The too great luxuriance of growth is thus checked, and a disposition to bear in consequence brought on.

Apple-trees sometimes begin bearing at the age of two or three years; but when they are six or seven, they are for the most part found to produce the most plentifully. See *Orchard*.

APPROPRIATION *of Lands*, a term used to signify the dividing and inclosing of such as are in a waste and unproductive state. The late scarcity of the produce afford by land, and the vast sums expended in procuring it from other countries, by the nation, strongly show the necessity of a particular attention to this point by the proprietors of lands, as well as the nation in general. See *Waste and Commonable Land*.

APRIL, the fourth month of the year, consisting of thirty days. In this month much important farming business is generally to be performed. If the wea-

ther be dry and fine, it is the proper period to begin sowing barley and white oats, or to continue the sowing of such spring-corn as has been commenced in the preceding month. Lucern, sainfoin, burnet, checory, mustard, buck-wheat, flax, and hemp, should also be sown at this time: and several articles may be planted out, such as liquorice, teasels, rhubarb, tobacco, hops, mangel wurzel, madder, weld, woad, &c. The autumn-sown cabbages should likewise be planted out, and seed drilled in where the plants are to remain. Furze seed may likewise now be sown. It is the proper time for preventing the growth of weeds, and destroying such as have already sprung up by the free use of the hoe among the early plants, as in crops of potatoes, carrots, parsneps, peas, &c. And the turnip fallows may be stirred, if necessary; and, where the land is stony, they may be picked off and cleared.

Timber intended to be barked, if the spring be forward, should now be cut down; and coppices thinned out and preserved from cattle. Geese, swine, and poultry, should be kept out of the commons, pastures, and grass-lands. Young turkeys and chickens should be particularly attended to. New-planted trees, if the weather prove dry, must also be well watered.

Ditches should be cleaned or scoured out; and such manure as lies in the fields, lanes, or other places, be brought and thrown up into compost heaps near the places on which they are to be applied.

Osiers, willows, and other aquatic plants, should be set, before they become too forward; and also slips of rosemary and lavender.

Throughout the whole month, clovers and other common field-grasses may be sown; and such grass-lands as are intended for mowing may be cleared from all sorts of obstructions to the scythe, and rolled down as level as possible. The winter-fed cattle must be constantly selling off, as well as the sheep.

The treading of cattle at this season of the year, upon grounds which are liable to poach, does great mischief; and, even where the land will bear, the animals wander about to little purpose but to scatter and waste their dung, and damage the growth of the young wood in different places by browsing and nipping off the tender buds. Besides, where they are turned too early into spring feed, the bite is not only insufficient for their support, even when they have the opportunity of ranging over a great breadth of land, but the grass and hay crops are thereby anticipated, and greatly lessened. These considerations should induce the attentive farmer to be careful in proportioning his stock to his winter-resources, that he may not sustain any loss throughout the season; and that his cattle, by being well fed instead of losing in condition, at that time, may be carried well forward, the lands and growing crops being left in a full state of growth and security. It is, however, essentially necessary that every farm should be stocked with an adequate number of cattle, as the improved state of husbandry points out a variety of resources for the provision of winter-food for their support. Every attention should be paid by the careful farmer to provide full supplies of food for his stock at this scarce and difficult season. Preserved Rouen, and watered meadows, are of the utmost importance in this view for the sheep system. The business of the fences should now be concluded, if not done before, as it is bad management to have any thing of this sort performed after this time, as the hedges never succeed well in such cases.

AQUATIC, any thing which relates to water.

Aquatic *Manure*, such manure as is formed in consequence of the dissolution or decay of various aquatic vegetables, and deposited at the bottoms of ponds, ditches, and other similar places. It is remarked by Mr. Marshall, in his Rural Œconomy of the Midland Counties, that he dressed lands with the aquatic manure, (raised two or three years before out of a fish-pool, and afterwards turned up into a heap of digests), the rest of the piece being manured with yard-dung; the quantity of each about eight loads an acre. The two lands dressed with the aquatic manure were obviously the better crop of turnips. The plants were not more numerous, but they were larger and cleaner-skinned; and what is remarkable, while the crop of the piece in general was full of catlock and chickweed (which arose after the hoeing), the two lands where this manure was applied were, in a manner, entirely free from these weeds. See *Manure*.

Aquatic *Hedges*, such as are raised from plants of the aquatic kind. See *Fence*.

Aquatic *Plants* are such plants and trees as grow in water, or watery situations. Thus, the willow, osier, alder, poplar, &c. are aquatic plants. They are proper for being planted where the soil is inclined to moisture, though they succeed best when they are not over wet. It is observed by Mr. A. Young, in his Calendar of Husbandry, "that if any part of the fences of the farm are situated in low, wet, or boggy places, it is a chance if thorns prosper well. The best method of repairing them is to plant trunchions of willow, sallow, alder, &c. for hedge-stakes, and along the bank, for plashing down afterwards, which will ensure the tenant a great plenty of firing; and in such situations, and in waste spots that cannot easily be better improved, it will answer extremely well to set longer trunchions for pollard-trees. They repay, he says, the expense with great profit." And further, that February is "a proper time to plant osiers and other sorts of willows. No part of the farmer's business, he thinks, pays better than such plantations, and especially if he has any low, spungy, boggy bottoms near a stream. The land should, he says, be formed by spade-work into beds six, eight, or ten, feet broad, by narrow ditches; and if there is a power of keeping water in these cuts at pleasure by a sluice, it is in some seasons very advantageous to do so. The late Mr. Forby, of Norfolk, he observes, knew the value of these plantations well, for various purposes. Osiers planted in small spots, and along some of his hedges, supplied him with hurdle-stuff enough to make many dozens every year, so that he supplied himself entirely with that article, as well as with a profusion of all sorts of baskets, especially one kind that he used for moving cabbage-plants, for which purpose they were much better than tumbling the plants loosely in a cart." It is added, that he cut "the common osier for this purpose at three years, and that with yellow bark at four." Many situations

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on large farms offer for this useful practice, which should never be lost sight of by the farmer.

ARABLE, that which relates to, or is capable of admitting the plough.

ARABLE *Farm*, that kind of farm which is either wholly or in a great measure under the plough. The soils most proper for this sort of management are all those of the more light and dry kinds, which are not adapted to the growth of good herbage or grass crops. As it is generally necessary, on farms of this description, to keep a number of animals for the purpose of performing the labour of them, and as much manure is also required for their advantageous cultivation, it seems probable, that they may be managed to the best account by having some part of them in grass, or under such a system as is capable of providing other substitutes for the feeding of animals.

Mr. Wimpey, in the fifth volume of the Letters and Papers of the Bath and West of England Society, in speaking of the method of improving small arable farms, observes, that it is generally thought, and on very good grounds, that small arable farms do not afford the occupier so good a maintenance as dairy farms of the same annual value. That the latter will do well and save money, while the former, with a vast deal more labour and trouble, is starving himself and family. The advantage and propriety of applying land to the growth of such articles to which nature has most fitly suited it, is evident, and also that all land which is naturally and probably arable, can by no means be converted into meadow, or valuable pasture of any duration. Such as, from a wild state of nature, over-run with furze, fern, bushes, and brambles, has been rendered fertile by means of the plough, must be kept in that improved state by its frequent use, otherwise it would soon revert to that wild barren state which was its original condition.

A farm, therefore, which consists wholly, or almost so, of land that is properly arable, must ever continue arable; for it is not practicable to render it in any degree fertile, but by means of a plough; or to keep it long so, even when it is made so. But though arable land cannot be converted into meadow or pasture proper for a dairy, it may be planted with articles which, it is well known now, will answer the purpose of feeding horned-cattle, especially milch-cows, as effectually as good meadow or pasture, producing as much milk, and altogether as rich, as sweet, and as good. But the great interesting question is, Whether those articles which can be procured only by the heavy expenses of ploughing, harrowing, seed, and other operations which necessarily attend their culture and harvesting, will afford as much sustenance in proportion to the expense as meadow or pasture which is liable to little or none, excepting what is made into hay, the cattle gathering it for themselves as they consume it?

To ascertain this fact, says he, we must inquire, what may be the average expense of keeping a milch-cow on a dairy-farm for any given time? It is said, upon very good authority, that the expense generally is from *3l.* to *3l.* 10*s.* per annum. Two acres and a half of pasture fit for this use is sufficient to keep a cow the whole year through, and such land is valued at from 25*s.* to 30*s.* per acre. At 25*s.* suppose, the keeping of each cow would amount to *3l.* 2*s.* 6*d.* per annum. A dairy-farm, therefore, consisting of forty-eight acres at 25*s.* per annum, would amount to 60*l.* rent per annum; and the number of cows that might be kept upon such a farm, allowing two acres and a half to each cow, would be nineteen and a fraction, therefore we will say twenty. In the next place, let us inquire, what would be the average expense of keeping a cow upon food raised in arable land as a succedaneum to grass, &c. rent and every necessary expense included? We are, he remarks, assured, by unquestionable authority, that a bushel of potatoes, given half at night and half in the morning, with a small allowance of hay, is sufficient to keep three cows a day. On that allowance their milk will be as rich and as good, and the quantity as great, as in the summer months when the cows are in good pasture.

It has been shown, that an acre of land, properly cultivated with potatoes, will produce 337 bushels, and the total expense of cultivating an acre, rent and tithe included, is 6*l.* 13*s.* 7 *d.* If three cows eat seven bushels per week, then they would eat 365 bushels in a year; and twenty cows would consume 2433 bushels. The question then is, If 20 cows require 2433 bushels to keep them a year, and as about an acre of land properly cultivated will produce 337 bushels net, how many acres will be required to produce 2433 bushels, or the quantity necessary to feed 20 cows to keep them in full milk the year round? The answer is, Seven acres and a quarter nearly. If then an acre of land can be cultivated with potatoes, as above, for 6*l.* 13*s.* 7½*d.* the cultivation of seven acres and a quarter will amount to 48*l.* 8*s.* 9¾*d.* We have seen, as above, that the rent of a dairy-farm, capable of maintaining twenty milch-cows, is upon a medium 60*l.* but it clearly appears that the same number of cows may be kept equally well on a very small part of an arable farm planted with potatoes for 11*l.* 11*s.* 2¼*d* less than that sum, which is so much in favour of the arable farm: or, in other words, seven or eight acres of arable land, under this mode of management, are much superior to forty-eight acres of meadow or pasture, as the difference of the two sums mentioned; the arable farmer receiving as great a sum for the expenditure of 48*l.* 8*s.* 9½*d.* as the dairy farmer doth for his bare rent of 60*l.* without reckoning a penny for incidental expenses. It must be observed, that, in this statement, no allowance is made for the small quantity of hay given to the cows with the potatoes. It must be noted also, that the account of cultivation is charged with 40*s.* an acre for manure, and some expense of ploughing, which of right is chargeable to the crop of wheat that is to follow. Now, if we deduct 40*s.* an acre from the expense of cultivating the potatoes, it reduces the sum to 4*l.* 13*s.* 7½*d.* and the whole expense then upon seven acres and a quarter is only 33*l.* 18*s.* 9¼*d.* and consequently the keep of twenty cows is little more than half to the occupier of the arable farm what it is to the occupier of the grazing farm. If this conclusion, says he, be fairly drawn, and the calculation free from errors, it is matter of the greatest importance, especially to the little arable farmer. It

plainly raises him from a state of acknowledged great inferiority, to one altogether as superior.

It may be said, this calculation respects potatoes only; how will this mode of culture answer when applied to the growth of other articles of food used as a succedaneum to herbage? Let us try. By an experiment made on a pretty large scale, lately, by Mr. Vagg, it seems to appear, that cabbage on arable land is much about as superior to natural pasture as potatoes.—His experiment was made on twelve acres of land, which was far from being the most suitable for a crop of cabbage. The average value about 30*s.* per acre, and the whole expense of the culture, carting-off included, 1*l.* 11*s.* 1*d.* per acre. The rent and expenses of cultivating the twelve acres then amounted to 38*l.* 9*s.* He says, the stock he fed with it was forty-five oxen, and upwards of sixty sheep; that it fed them three months, and that he is very well assured that they improved as fast upon it as they do in the prime months of the season, May, June, and July. Now if, instead of sixty sheep, we reckon fifteen oxen, or that four sheep are about equal to one ox, in which we cannot err much, then sixty oxen were kept well for three months, or, which is the same thing, fifteen oxen for a whole year, for 38*l.* 9*s.* and consequently twenty would cost 51*l.* 5*s.* 4*d.* which is not quite 3*l.* more than the keep of twenty cows cost in potatoes.

It is somewhat extraordinary that two experiments, made on articles so very different in their nature, should so nearly coincide in their effects when applied to the same purpose. Turnips, turnip-rooted cabbage, carrots, parsneps, and some other articles, by many experiments often repeated, have been found quite adequate to the same valuable purposes, at least so far as to be more lucrative than meadow or pasture. Mr. Wimpey omits clover and rye-grass, because they have been long in general practice; but are in common very short of the advantages which may be derived from the cultivation of the other articles recommended.

There is one other article, however, which is particularly worthy of the arable farmer's utmost care and attention, which he may rely on with great confidence, if he will be at the pains of thoroughly cleaning his land, and of keeping it so for two or three years after it is planted. This article is sainfoin. From the miserable appearance it often makes the first year, the writer long doubted if its success in poor land was not very precarious; but he has now the fullest conviction, that it will grow and produce a very good crop in poor land, provided the soil be dry, and proper care be taken to keep it clean till it be fully established in the ground. Small arable farms, which in a manner are quite destitute of herbage, cannot well be supplied with any substitute that is by any means its equal. Indeed one acre of good sainfoin is of more value than two acres of middling meadow or pasture. And as it will thrive so well on a very poor soil, the arable farmer, who either keeps no cows for want of herbage, or keeping them is pinched for food for them, is perfectly ignorant of the advantages attending the culture of this plant, or miserably indolent and inexcusable in not better attending to his interest. Whatever crop precedes the planting sainfoin, the ground should be ploughed in the winter, and laid up in sharp deep ridges, by one bout of the plough, to continue till the beginning of April. Then it should be dragged and harrowed level: and if the land be very poor, it should have some light dressing of ashes, soot, or a compost of lime, earth, and rotten dung, well incorporated together. A small quantity of either of these would greatly encourage the plants in their infant state. The beginning or middle of April, as the season may prove, the seed should be sown, and there would be little danger of its succeeding to one's wish. Perhaps there cannot be a better or a surer means of cultivating this very useful plant to the greatest advantage, than by sowing it after potatoes. The horse and hand-hoeing them during their growth, and the ploughing, dragging, and harrowing the ground to clean it of the potatoes, so thoroughly destroy the weeds, and pulverise the soil, that it is made in the most perfect condition for a crop of sainfoin; and though the land may in its nature be very poor, the manuring properly for a crop of potatoes, and that being grown perfectly rotten, the soil is become sufficiently fertile.

Besides the above, perhaps, there are very few articles in use as substitutes for pasture, that are equally profitable with carrots and parsneps, when the soil is suitable to their manner of growth and culture. The soil they delight and flourish most in, is a deep, light, free soil, which is easily penetrated, and moderately fertile. In such a soil, if properly hoed and set out at due distances, they will arrive at a great magnitude, and the acreable produce be very surprising. Another advantage is, their being so very acceptable to the farmer's stock of every kind. Horses, cows, sheep, and hogs, eat them seemingly with the same appetite, and are equally improved by them. Unfortunately the quantity of such land bears but a small proportion to what is totally unsuitable to them. Hard, stiff, obdurate land, and such as strongly coheres, is quite unnatural to them, and never answers the expense and trouble; what grows in such land being very short, generally forked, and of small value. Potatoes, cultivated as above directed, would, he thinks, be as good a preparation for those roots as can well be invented. If the soil be well manured for the potatoes, it will be sufficiently fertile for carrots and parsneps; and, lying through the winter in fallow, will be in excellent order for sowing the seeds of these roots the March following.

Upon the whole of this account, it seems clearly to follow, that an arable farm of 50*l.* or 60*l.* per annum, though it has not an acre of meadow or pasture land belonging to it, may, by skill and proper management, be made to produce as much and as good butter and cheese, as a dairy farm of the same value, and have a large proportion of land left for the growth of corn and other purposes. For instance, twenty acres of the sixty, he conceives, would be competent to the maintenance of the stock above-mentioned, and they might be fitly divided as follows: viz.—Six acres of potatoes, two or four of cabbages, two of turnip-rooted cabbage, and two of

turnips, making together twelve or fourteen acres; the remainder to be sainfoin; in all twenty acres. The proportion to be varied, and some articles exchanged for others, as the nature of the soil and particular circumstances might require, and as the farmer might think fit and proper. On twenty acres thus planted, he reckons, besides twenty milch-cows, six or eight young cattle, and pigs in proportion, might be well kept on the offal.

It may be asked, should this plan be generally adopted by the farmer, for whose use it is principally intended, if it would not be running out of one extreme into another? If so considerable an increase of milk, butter, and cheese, would not lower the prices of these articles too much, and raise the price of wheat in a greater proportion? That it would lower the prices of these articles is very certain, and it is a very desirable circumstance that they should. There is little danger, however, of the price of wheat being advanced by the appropriation of about twelve acres of land, out of such a quantity, annually to the cultivation of the above articles; for the land would be so much improved by the extra tillage given to the soil intended for those articles; and also during their growth, that he is rather of opinion, they would produce more corn than if constantly planted in the usual very imperfect manner.

The greatest obstacle to this mode of managing a small farm, as from 20*l.* to 60*l.* per annum, is, the confined or narrow circumstances of the occupiers of such farms. In general, their capitals are much too small to carry on their business to any advantage in the present mode of management; but the mode recommended would require an increase of capital to the extent of 200*l.* or 300*l.* Less than 400*l.* would not stock a farm in this way of 60*l.* per annum, at any rate; but a capital of 500*l.* would be vastly more convenient, and indeed much more to the farmer's advantage.

If the improvements proposed are so interesting to the individuals immediately concerned, how very important are its effects in a political view, as it respects the community at large! If eight acres of land, by skill and management, can be rendered as productive and as profitable as forty-eight acres, whose natural produce is of a medium value, it is virtually increasing the extent of territory in a sixfold proportion; for, if every acre of land could, by art and industry, be made to yield six times the quantity of produce it does at present, the whole might be rendered capable of supporting six times the number of the present inhabitants. But this is far from being the whole of the advantage that will accrue from it. It will not only increase the quantity of provisions as aforesaid, but it will also find abundance of employment for the poor labourer and his family. In this respect dairy-farms are in a manner of no use; they afford little or no employment at all for the poor labourers. All the above calculations are much too low for the present period. See *Farm.*

Arable *Fields*, such as are principally kept under the state of the plough. For this purpose they should be more open than when they are intended to be kept chiefly in the state of pasturage; but the particular size, shape, and direction, must depend in a great measure upon the situation, position, nature of the soil, and other circumstances, which will be more fully explained in considering the nature and manner of laying-out farms. See *Farm.*

Arable *Land*, such land as is tilled or cultivated by means of the plough, for the purpose of producing grain and other sorts of crops.

It is a matter of great importance to society, to determine what are the requisites which distinguish fruitful lands from such as are less productive. Since vegetables evidently imbibe from the earth and surrounding atmosphere, the principles of oil, mucilage, and other peculiar products, only found in organised substances, it can scarcely be doubted but that manure, or the remains of other decayed organised substances, renders lands fruitful, by supplying these materials ready formed. It may happen, however, that the putrefactive process in a considerable quantity of manure may be so effective as to overcome the vital powers, or destroy the organisation of the plant; and on this account an excess of manure must be hurtful. In those cases, wherein vegetation is performed without the presence of any thing which may be called manure, it seems proper, as far as the few and imperfect lights which we possess can serve to direct us, to ascribe the growing or augmentation of vegetables to the decomposition of water, or the air of the atmosphere, rather than to any considerable addition of earthy particles; more especially, as it appears, from good experiments, that the earth in which vegetables grow, suffers very little loss of its weight in consequence of their increase. From the indispensable necessity of water in vegetation, it appears that this fluid either supplies the greatest part of the mass of vegetables, or is at least the vehicle or medium by which aërial fluids are condensed and conveyed into the vegetable substance; which leads to a conclusion, that, in general, those earths which are the best adapted to imbibe and retain water, and at the same time admit the access of air, are most fruitful. Sand, or small particles of siliceous earth, are evidently the least adapted to this purpose. Clays of considerable purity will be too stiff, impenetrable, and adhesive. Chalky or calcareous earths are not only hard and permanent, so as to be with considerable difficulty penetrated by the roots of vegetables, but are little better adapted either to imbibe more water than they naturally possess, or to part with that they already have. The ponderous and magnesian earths, as they do not enter in any considerable proportion as ingredients into soils, need not be much attended to by the agriculturist. If we were, therefore, permitted to overlook the presence of saline and combustible matters, which are, indeed, necessary to fertility, and the latter of which is the cause of the dark colour of mould, we should be naturally directed to a mixture of the siliceous, calcareous, and argillaceous earths, that is to say, of sand, chalk or lime, and clay. The first, being totally insoluble in water, can scarcely be expected to answer any other purpose than that of mechanically separating the parts of the mass, or at least of rendering them more easily separable by frost and other atmospherical changes. The calcareous and ar-

gillaceous earths form the composition distinguished by the name of marl, and this will vary in its properties according to the nature of its composition; the friability and solubility of the lime in water serving greatly to correct the bad effects of the mere clay, while this, on the other hand, produces a change of equal advantage in the chalk or lime. It may easily be apprehended, too, that the presence of vitriolic acid, or other acidifiable substances, together with the access of air, must produce changes, by combination with these two earths, which may have considerable influence on vegetation. Different kinds of arable land, in respect to the texture and other qualities, are therefore adapted to the growth of different crops; but for the production of most sorts of grain they should be rather dry, and of a friable nature. This is particularly the case in regard to barley; wheat and oats may, however, be grown on such lands as have considerable tenacity.

It is remarked by the earl of Dundonald, in his Treatise on the Connection of Agriculture with Chemistry, that the arable land in Scotland formerly consisted of outfield and infield. The infield, in the treatment it received, and in its quality, resembled the inclosed cultivated lands in England; while the outfield was similar to the uninclosed common field lands in that country. There is reason, he thinks, to believe, that this distinction, prior to the date of inclosures, was likewise general throughout England. It is wearing out fast in Scotland from the same cause.

That part of the farm called the outfield land, he observes, never receives any manure. After taking from it two or three crops of grain, it is left in the state it was in at reaping the last crop, without sowing thereon grass-seeds for the production of any sort of herbage. During the first two or three years, a sufficiency of grass to maintain a couple of rabbits per acre is scarcely produced. In the course of some years it acquires a sward; and, after having been depastured for some years more, it is again submitted to the same barbarous system of husbandry.

The other division of the arable land consisted of the infield or croft land, to which the whole dung produced on the farm was exclusively applied. By this mode of treatment, these last-mentioned lands were made fertile at the expense of the others; and, by a repetition of this practice for many centuries, a superabundance of vegetable matter has therein been accumulated. Too great a proportion of inert vegetable matter, he says, causes ground of this description to be too loose and open for most kinds of grain; particularly for winter corn, which, by the alternate changes from frost to thaw, and *vice versa*, is liable either to be destroyed or spewed out of the ground. Black infield mould of this description, especially when it contains a due proportion of calcareous matter, produces a rich and luxuriant herbage: it should, therefore, he thinks, be kept in a proper rotation of pasture and tillage, and not in tillage alone, as is still the prevailing practice in many parts of Scotland.

By the dung, and still more so by the urine of cattle, lands of this nature, after having been depastured for a certain number of years, will, he says, be found to have received considerable benefit, and to have become more fitted for the production of crops of grain. This, in his opinion, is principally to be ascribed to the effect which the volatile alkali of the urine has, in dissolving a proportion of the superabundant oxygenated inert vegetable matter contained in the soil.

On restoring arable land to grass, Mr. Middleton observes, in his View of the Agriculture of Middlesex, that the most usual method in that county is to manure well, and to cleanse the soil thoroughly with hoeing crops, one year previous to sowing hay-seeds with barley or oats. In cases where the soil is so rich that there might be some risk in sowing a full crop of corn, by which the grass would be smothered, less corn is sown, even below one-half the usual quantity of seed, in order that it may serve the double purpose of a nurse to rear up the young plants, and a shade against the rays of too hot a sun. When the corn is carried off, the young crop of grass is but little fed during autumn; but it is heavily rolled in the following spring, in order to press the soil home to the roots; and it is then treated as permanent grass. The foregoing method, says he, is perfectly unexceptionable, as to all land that has been well supplied with manure. Where it is known that the land is not so highly conditioned, the operation would be equally successful by cleansing the ground well after a crop of winter tares had been fed upon it; then laying on manure, ploughing it in with a thin furrow, and in August or September sowing grass-seeds without corn. The produce will be a most abundant crop of hay (though rather coarse) the next summer. He has, he tells us, changed much land from arable to grass, by both these methods, with equal success, except in a single instance, which convinced him that the trefoils will not stand a severe winter, when sown late in September.

Farms on the western coast should, the same author thinks, after being well drained, be laid pretty generally down with grass-seeds. The humidity of the climate in that district of the island is certainly unfavourable to the general growth of corn; though the drier lands in this situation are excellent for root crops. Grass should undoubtedly be the staple; roots might be grown to clean and renovate the land, and one crop of corn to lay down with. This would keep all the west in a constant high state of fertility.

Mr. Marshall very justly observes, "that grasses improve the land, and those who wisely adhere to having a large proportion of their farm in them, may boast of a constant plenty of crops. It is the subterfuge of ignorance or knaves, to say that grasses do not thrive in their lands; but the true reason is, because they do not lay the lands in proper condition, nor with proper grasses and good seeds; for certain it is, that where corn grows, there grasses may grow also; and that they are, when properly managed, very profitable to the farmer, let his land be whatever it may, as they keep the land constantly in good heart, and so afford the most constant and rich produce to the cultivator."

It is further remarked, in the same work, by Mr. Middleton, that it is the practice of *some* farmers, in most other counties, to continue sowing corn so long as the land will produce any, and then to apply to the landlord or his steward, saying, that they are ready to lay such a field (thus shamefully exhausted!) down

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to grass, provided he will give them permission to plough up an equal quantity of old grass land. In this application they too often succeed; and thus they go on ruining one field after another.

And Mr. Billingsley, in the Survey of the County of Somerset, says, that, as there are, perhaps, few things in husbandry more difficult to be accomplished than that of restoring worn-out arable land to a good pasture, a few hints on the subject may not be unacceptable: The first step is, to extirpate from the land all noxious weeds. This may be done by a complete winter and summer fallow; or, in place of the summer fallow, by a crop of potatoes, well manured, and kept perfectly clean, and followed by winter vetches, fed off in the spring. At the latter end of May, or beginning of June, sow one bushel of buck-wheat per acre; and when that is up, and in rough leaf, harrow-in (choosing, if possible, moist weather) two bushels of hay-seed collected from the best meadow hay, half a bushel of rye-grass, four pounds of marl-grass, and four pounds of white Dutch clover. The buck is intended principally as a screen to the grass-seeds. If, therefore, the harrowing should pull up some of the plants, so much the better. A thick crop is not desirable. After the buck-wheat is harvested, which will be some time in September, let the field be hayed, or shut up for the winter; and let it be fed the next summer with sheep, or any kind of cattle except horses: the latter animal will tear up the young plants with his teeth. Should this pasture, in the course of three or four years, decline in fineness of herbage, and become coarse and rough, which is frequently the case, give it a top-dressing of lime, or lime mixed with pond or ditch earth, or the scraping of a road made with lime-stone or marl; and, if neither of these can be procured, with coal or soapers' ashes, or any kind of compost; and, two years after either of the above manures are administered, serve out some good meadow hay-seeds on it in the months of January and February, and then give it a complete covering of rotten dung.

By this method a good permanent pasture may be obtained. If the arable ground so laid down be intended for pleasure-ground, omit the rye-grass, and add the natural grass-seeds. See *Laying Lands down to Grass.*

Mr. Middleton, in the close of his valuable View of the Agriculture of Middlesex, makes the following attempt to estimate the quantity of arable land in South Britain, from the supposed number of inhabitants; and also the proportion of the *whole* quantity of land occupied by each species of crop; and offers statements of the probable number of horses and sheep; of the quantity, and mode of consumption, of animal food, and the various products of the soil; of the weight and value of wool; and of the total amount of agricultural produce.

The best opinion, says he, appears to be, that there are about *eight millions* of inhabitants in South Britain; and that all those who eat wheaten bread, consume annually one quarter, or eight Winchester bushels, of wheat each; which includes puddings, pies, confectionary, and every other application of wheat in the article of food: indeed he knows, he says, this allowance of eight bushels to be nearly correct as to some families. This quantity of wheat is about equivalent to the average net produce of half an acre of land; that is, after deducting seed, loss by vermin, accidents, &c. from the gross produce, the remaining net quantity is sixteen bushels per acre.

Those persons who eat bread made from spring corn and rye, will in like manner require the net product of *half an acre*; as the flour of this sort of grain is so much deficient in quantity, weight, and nourishment, as fully to balance the greater number of bushels per acre in the produce: therefore,

	Acres.
Half an acre each person is - -	4,000,000
2dly, *Beer*—For a family of six persons, of all ages, will require 25 bushels of malt, and as many pounds of hops, annually; which he supposes is about equal to three bushels and a half of barley each person; but as there are many who do not drink malt liquor at all, this would be too large an allowance for all England and Wales. He therefore estimates it at three bushels each, which, for the assumed population, is 24 millions of bushels, or three million quarters of barley, and, at three quarters per acre (after allowing four for seed, &c.) is, in acres	1,000,000
Distillers—One-tenth of the last number	100,000
Starch, hair-powder, and other manufactures; loss by vermin, damp, and casualties, the produce of -	80,000
Corn consumed by oxen, sheep, hogs, poultry, rabbits, &c. - -	40,000
Horses—Consume corn to the amount of the produce of from one and a half to three acres each, or, on the average, two acres.	

	Horses.
Arable land employs about one horse to every fifteen acres, which, on 14,300,000 acres, is - -	933,333
Grass land employs one horse to every 100 acres, which, on 21,300,000, is -	213,000
Number of horses used in agriculture - -	1,146,333

Horses kept for pleasure, and taxed	200,000
Ditto, but not entered -	40,000
Post-chaise horses, mail-coach do. stage-coach do. hackney-co. do &c. supposed to be about	90,000

Carried forward	1,146,333	5,220,000

	Horses.	Acres.
Brought forward	1,146,333	5,220,000
Horses used in waggons and carts, in mills, canals, and navigable rivers; in caravans, & for all the other purposes of draught not before described	240,000	
Cavalry of all the various descriptions	30,000	
Number of horses not used in agriculture proper	600,000	
Total number of horses	1,746,333	
	Acres.	
Which, at 2 acres each, will consume the produce of arable land	3,492,666	
Colts, though too young for labour, are allowed a little corn, which he supposes to be as much as the produce of about	65,334	
Total quantity of land producing horse-corn		3,558,000
Land cropped with turnips, carrots, parsneps, cabbages, and potatoes, coriander seed for the brewers and druggists, canary seed for birds, and with dyers, physical, and culinary herbs; cultivated by the plough		1,400,000
Clovers, rye-grass, &c. one year's ley, in the proportion of 1-10th		1,400,000
Fallow—In the proportion of 2-10ths		2,800,000
The consumption of the country requires in aration		14,378,000
But we import corn proportionate to the produce of upwards of		378,000
Which deducted from the foregoing number, leaves the quantity of arable land in South Britain rather under		14,000,000

In order to discover the quantity of land cropped with each species of grain, he adopts the following *hypothesis*, founded on his own observations, made in most of the counties in England, viz. that, including the common arable fields, 6-10ths of all the arable land in South Britain, is cultivated under the old system of wheat, spring corn, fallow: 3-10ths is in something like the rotation of wheat, turnips, spring corn, clover: and the remaining 1-10th is in a course of oats, roots, clover.

	Total.
First position, 6-10ths divided by 3—fallows 2—wheat 2—oats and beans 2	6
Second position, 3-10ths divided by 4—wheat 0,76—barley and rye 0,75—roots 0,75—clover 0,75	3
Third position, 1-10th divided by 3—oats and beans 0,5—roots 0,25—clover 0,25	1
General proportion—fallow 2—wheat 2,75—oats and beans 2,5—barley and rye 0,75—roots 1—clover 1	10

According to this statement, every ten million acres of arable land is cropped in the following proportion, viz.

Wheat	2,750,000 acres
Oats and beans	2,500,000
Barley and rye	750,000
Roots	1,000,000
Clover	1,000,000
Fallow	2,000,000
Total	10,000,000

By which also it appears, that the corn-crops, including beans, are in the proportion of six to ten; the green crops, in that of two to ten; and the fallow, of two to ten.

Having before shown that there is at most 14 millions of acres of land in aration in South Britain, we must, he says, in order to discover the quantity of land annually cropped with each species of grain, &c. apply the foregoing postulatum; and say, As 10 is to 2,75, so is 14 to 3,850,000 acres of wheat; and as 10 is to 0,75, so is 14 to 1,050,000 acres of barley and rye; and so of the rest. Which shows that the soil of England and Wales is annually cropped with the following quantities of each kind of grain, &c. thus:

	Acres.	
Wheat	3,850,000	
Barley and rye	1,050,000	
Oats and beans	3,500,000	
Clover, rye-grass, &c. 1 year's ley	1,400,000	
Turnips and other roots, as aforesaid	1,400,000	
	11,200,000	
Fallow, as aforesaid	2,800,000	
Together		14,000,000
Hop-grounds—On the supposition that ten millions of inhabitants in Britain and Ireland, use 3lb. each, and that rather under 6 cwt. is the average produce per acre, the total quantity would be 261,000 cwt. or		44,000
Nursery-grounds about		10,000
Fruit and kitchen-garden cultivated by the spade		50,000
Pleasure-grounds—The dressed and unprofitable parts only: the rest being either pastured by cattle, or mown for hay		20,000
Carried forward		14,124,000

Brought forward - -	14,124,000
Land depastured by cattle; leys of more than one year: meadow of natural grasses, meadow of sown grasses, and water-meadow and orchards on grass-land, which includes the cider counties. This quantity of grass-land includes parks, paddocks, and pleasure-grounds, that are either mown for hay or grazed by cattle -	21,300,000
Hedge-rows, copses, and woods -	2,000,000
Ways, waters, &c. - - -	1,603,000
Cultivated land in England and Wales	39,027,000
Commons and waste lands, as mentioned in Sir John Sinclair's Address to the Board of Agriculture - -	7,889,000
Total in England and Wales	46,916,000

	Acres.	
Horse food equivalent to 1,746,333 horses, at four acres each, is - -	6,985,332	
Ditto, colts under the age of labour, and horses past labour - - -	514,668	
		7,500,000
Fallows - - - - - -		2,800,000
Ways and Water - - -		1,603,000
Pleasure-grounds - - -		20,000
Manufactories, vermin, damp, must, &c. -		80,000
Nursery-grounds - - -		10,000
Hedge-rows, copses, woods - -		2,000,000
Druggist's physical herbs, roots, &c. -		10,000
		14,023,000
Commons - - - - - -		7,889,000
Together - -		21,912,000

to be taken from 46,916,000 acres, the quantity of land in England and Wales, leaves 25,004,000, whereof the produce is consumed by human beings in the proportion of 3 1-8th acres each. By attending to the preceding part of this account, it will appear that it is divided in the following proportions: namely, for bread $\frac{1}{2}$ an acre; for liquids $\frac{1}{8}$th of an acre; for animal food, near $2\frac{1}{2}$ acres; and for roots, greens, and fruit 1-50th of an acre. Should the commons be included in the quantity for supplying animal food, they would increase that part of the account to 3 48-100 acres.

No person, says he, will expect any of these quantities to be mathematically true, particularly as we have no maps of England that can be depended on for the purpose of ascertaining the quantity of land, not even, perhaps, nearer than eight in ten of the actual quantity. This sort of calculation is only meant to furnish the mind with some general ideas respecting England and Wales.

There are annually sold, he further states, at Smithfield-market, about 100,000 bullocks and 700,000 sheep. There are many sold at several of the towns and large villages near London, of which no account is taken, perhaps equal to the supply of Southwark, and all the places out of this county that lie within five or ten miles of town: consequently, the inhabitants of this county consume nearly as much animal food as is sold at Smithfield.

For Middlesex.

	Stone.		
100,000 beasts, at 100 stone, of 8lb. each, is	10,000,000	at 4*s.* is	£.3,400,000
700,000 sheep, at 10 stone each -	7,000,000		
Lambs $2\frac{1}{2}$, calves $2\frac{1}{2}$, hogs and pigs 2, together -	7,000,000	at 5s. is	1,400,000
Poultry, game, and fish, 5-10ths; dairy, 6-10ths -	1,100,000	at 6s. is	220,000
Total -	25,100,000		£.5,020,000

which, divided amongst 648,347 inhabitants, is but little under 39 stone, costing about 8*l.* each person.

For England and Wales.

	Stone.
One million of bullocks, at 90 stone each, is - - -	90,000,000
Nine millions of sheep, at 9 stone each, is	81,000,000
Lambs 8, calves 8, swine, fish, poultry, game and dairy, 24; together -	40,000,000
Total - -	211,000,000

which, at 4*s.* a stone, offal included in the price, but not in the weight, amounts to 42,200,000*l.* sterling per annum; which, being divided among eight millions of inhabitants, is $26\frac{3}{8}$ stone; and being prized in the same manner, amounts to 5*l.* 5*s.* 6*d.* per head, the meat nearly to 4 lb. 1 oz. per week for each person.

It was, says he, given in evidence, on passing the last wool-bill, that the clip of England and Wales amounted annually to about 600,000 packs, or 144,000,000 of pounds, which sell at ten-pence per pound, and produce 6,000,000*l.* sterling.

He takes the average yield to be about $3\frac{3}{4}$lb. of wool from each sheep; therefore, dividing 144,000,000 by $3\frac{3}{4}$, gives him 38,400,000 as the flock of sheep; and he apprehends they consist nearly of

14,400,000	breeding ewes, which bring as many lambs, the former are killed off at an average of five years old, or annually - -	2,900,000
24,000,000	other sheep, which are killed off at an average of three years, or annually	8,000,000
38,400,000		
	Total number of sheep killed annually -	10,900,000

Brought forward	10,900,000
Lambs slaughtered	2,800,000
Lambs and sheep die carrion (principally from the rot) 1-20th of the two last numbers, or	700,000
Yearly increase and decrease	14,400,000

The mutton, taken at nine stone per sheep, gives 98,000,000 stones as the yearly consumption.

The foregoing statement, he observes, is drawn up from the arguments used on both sides of the two houses of parliament, and the evidence given on passing the last act for regulating the removal of wool.

It implies a greater quantity of mutton annually killed, than is to be met with in any other account, and a greater number of sheep than he thinks there are in South Britain. About three-quarters of a sheep per acre would probably average the cultivated ground. This would amount to $29\frac{1}{4}$ millions, and allowing $2\frac{3}{4}$ millions for the commons, would make 32,000,000 as the number of stock sheep in England and Wales; which yielding $3\frac{3}{4}$lb. of wool each, would be 120,000,000 lb.. or 500,000 packs, at 1*s.* per lb. is 6,000,000*l.* sterling.

In the proportion of 12,000,000	ewes, killed in five years, or annually	2,400,000
20,000,000	wethers in 3 years, or annually	6,700,000
32,000,000		

Total number of sheep killed annually	9,100,000
Lambs ditto	2,300,000
Lambs and sheep which die carrion	600,000
Yearly increase and decrease	12,000,000

The mutton, taken at nine stone per sheep, gives 81,900,000 stone as the yearly consumption.

The medium between the two accounts, is 10,000,000 sheep, and 90,000,000 stone weight of mutton.

He concludes by furnishing the following as the estimate of the annual produce of the agricultural capital of England and Wales:

11,200,000 acres	of arable land in crop annually at 5*l.*	£.56,000,000
44,000	of hop-ground, at 30*l.* is	1,320,000
10,000	of nurseries, at from 50*l.* to 100*l.* say at only 50*l.* is	500,000
50,000	of garden-ground cultivated by the spade, from 50*l.* to 100*l.* say at only 60*l.* is	3,000,000
		£.60,820,000
	Brought forward	£.60,820,000
20,000	of unprofitable pleasure-grou. which cost a quarter of a million in labour, and return nothing	
21,300,000	of grass-land, at 3*l.* is	*63,900,000
7,889,000	of commons	* 1,000,000
2,000,000	of woods, copses, and hedge-rows at 10*s.*	1,000,000
1,603,000	of ways, water, &c.	
44,116,000	Total annual produce of land	£.126,720,000
2,800,000	of fallow.	
46,916,000	total.	

Which costs in labour, artificers, and horse-keep	56,720,000
Remains, net increase in value on the produce of the land per annum	£.70,000,000

Of which, says he, the landlords take	42
The state, in taxes and tythes	13
And the farmers are permitted to share the remaining	15

which is all they receive in return for interest of capital, skill, industry, and attention.

And he further remarks, that if the manufacturing and commercial part of Great Britain were to be tried by this rule, namely, of sharing less than one-fourth part of their real gains, as appears to be the case with the agricultural branch of the community, they could not exist an hour under what they would term such severe oppression.

ARAIRE, the name of a small plough used in some of the southern departments of France. It consists of a ground-wrist, as represented at *a*, *b*, *pl.* II. *fig.* 3. from three to four feet long, ending in a point towards *b*. The under-part of this wrist, instead of being flat, is formed into a ridge, which extends the whole length of it. This ground-wrist, at the end *a*, terminates in a strong tenon, fixed in a large mortise, formed at the extremity *d* of the beam *d e*, and is besides fastened to the beam by two iron

* This part of the account might be varied by stating the amount of animal food at	42 2-10ths
The wool at	6
The tallow, skin, bones, &c. at	10
Fed by horses, &c.	6,7
The produce of animals	64 9-10ths

which is the same amount as in the text.

uprights $f\ g$, which have a head at g, and going through the beam are keyed at f. The distance between the under part of the beam about f, and the upper part of the ground-wrist towards g is about fifteen inches. Instead of these uprights, there is sometimes put a piece of sharpened wood or iron, as represented by the pricked line $h\ g$, which serves instead of a coulter.

On the upper part of the ground-wrist is fixed a large iron share, $d\ h$, represented at *fig.* 4; the part $d\ i$ is received into the same mortise of the extremity d, *fig.* 3, in which the tenon of the ground-wrist is fastened; and the wings of the share $k\ l$, *fig.* 4, rest upon the iron uprights $f\ g$, *fig* 3.

On the hindermost part of this plough is a single lever, $m\ d$, *fig.* 3, which serves for a handle: at the end d, where it is bent, it enters, as well as the ground-wrist and share, into the great mortise d, at the end of the beam; and the whole is secured with wedges. The handle sometimes consists of two pieces lapped one over the other, as at n, to lengthen or shorten it, according to the height of the ploughman.

By means of the wedges just mentioned, the angle which the ground-wrist forms with the beam may be altered at pleasure, which makes it plough more or less deep. At the hinder parts of the ground-wrist are two earth-boards, fastened at o by a strong wooden pin, which passes through both the boards and the ground-wrist.

The beam d, f, e, which is from eight to ten feet long, has an iron bolt at the end, e, which enters with great ease into a large mortise made at the extremity, g, of the piece of wood $q\ r\ s$, intended to pass between the oxen when they are employed, and to which their harness is to be fastened. When a single horse is used in the plough, a shaft is substituted instead of the piece of wood $q\ r\ s$, and fastened to the end of the beam e by an iron ringlet.

It is evident that this plough must go a greater or less depth, according as the draught is more or less raised. The ploughman, as has been already observed, can alter the angle which the ground-wrist forms with the beam, by means of the wedges he drives into the mortise of the beam, which receives both the ground-wrist and handle. But, these directions not being sufficiently exact, it is necessary that the ploughman should lean on the handle m, when it cuts too deep, and raise it when it makes too shallow a furrow. This labour is so constant, that, were the plough to work in a strong soil, the ploughman could not support it. The two little earth-boards, $p\ p$, turn over to the right and left the earth that has been loosened by the share; but this is not done so regularly as when there is but one earth-board, which throws the earth into the furrows before made, as fast as it comes out of that which the plough is forming: it is, however, certain, that the ground-wrist being ridged, the ploughman always rests it on one side, which occasions the greater part of the earth to be thrown one way.

These ploughs having no coulters, the earth is not cut vertically at all; for neither the piece of sharpened wood, nor the sheath which joins the ground-wrist to the beam, and which is placed a little before the small iron bars f, g, can be esteemed a coulter. The bar represented by the pricked line $h\ g$, may serve instead of a coulter; but it must then be made of iron; and in this case the coulter would be very improperly situated, for it should, by rights, be before the share.

These ploughs are sometimes very convenient to use among trees, or in vineyards; they may also serve to stir the ground in the intervals between the rows of sainfoin and lucerne; in which case they should rather be called cultivators than ploughs.

ARCHED, a term employed among horsemen. A horse is said to have arched legs when his knees are bent archwise. This only relates to the fore-quarters, and the infirmity sometimes happens to such horses as have their legs spoiled in travelling.

ARCHIMEDES'S *Screw-Pump*, a kind of spiral pump for raising water, so called from Archimedes, who is supposed to have been the inventor of it. This, though a very old method for raising water, is certainly not a despicable one for the purposes of temporary drainage. Water rises in the hollow screw of this pump on the principle of its endeavouring to fall. It consists of a long cylinder, with a hollow pipe, tube, or groove, running round it, as represented in *plate* II. *fig.* 1. The lower end being placed in the water, the upper should be raised up so high that the parts of the thread $c\ d$ may lie nearly horizontally, yet not so much so but that the declivity between d and c shall be such as to suffer the water to fall and form lodgements in the inferior parts of the thread, as at $c\ c\ c$: $a\ b$ shows the cylinder, and $e\ f$ the tube open at each end. It has an oblique position to the horizon, with the lower end in the water to be raised, and the other supported by the pivot l, below the winch m, by which the tube and cylinder are turned round.

As soon as the screw is immersed in the water, it immediately rises therein, by the orifice e, to the level of the surface of the water $g\ i$; and if the point of the spiral tube, which in the beginning of the motion is coincident to the surface of the water, happens not to be on the lower side of the cylinder, the water will, upon the motion of the screw, move on the spiral tube, till it comes to the point which is on the other side, and coincident with the surface of the water: when it is arrived at that point, as suppose at i, it cannot afterwards possess any part of the spiral but that which is upon the lowest part of the cylinder; for it cannot move from i towards g or d, because they are situated higher above the horizon: and since this will constantly be the case, after the water in the spiral has obtained the point i, it is plain that it must always be on the under part of the cylinder. But, as the cylinder is in motion, every part of the spiral screw, from c to f, will by degrees succeed to every part thereof from i to f, as it comes on the lower side; that is, it must ascend on the lower part of the cylinder through all the length of the pipe, till it comes to the orifice at f, where it will run out, as having nothing further to support it.

This engine may be very useful in raising water foul with sand, &c. as the leathers of pumps are soon destroyed by the particles of such substances. It was,

perhaps, principally this reason that induced the ingenious Mr. Smeaton to erect a machine of this kind in the gardens of her royal highness the princess dowager of Wales at Kew, where it is worked by horses, and supplies all the ponds, &c. in that extensive garden with water. A machine of this kind, turned by a windmill, might be of great use in draining lands in several parts of England, as it is not subject to be out of order, and might be made to raise a very large quantity of water to a small height. See *Draining of Land.*

The best way of making or constructing the screw-part of the engine is, not by means of a hollow pipe coiled round the shaft or axis, which is liable to many accidents, but by cutting a spiral groove about an inch deep, and the same width, round the axis, and extending near the whole length of it. Narrow boards of oak should be fitted to the groove, and made to join very close to each other sideways. They are then sawed off very even, and to the same height above the shaft; and narrow deal boards, close jointed, nailed upon the tops of the oaken boards, forming a hollow cylinder, which is bound with iron hoops. One end of this cylinder being dipped in the water, the other end is raised the intended height; and, by turning the cylinder or barrel round, the water is raised as explained above.

Sometimes this engine is made with only a single spiral partition or thread; but more frequently with three or four.

It is liable to few accidents; therefore, if well constructed, pitched within and without, and kept in a house, or under a dry shed, when not in use, will last a long time, with a very little repairing. The barrel may be made a little wider at the upper end than at the lower, that goes into the water, which answers two useful purposes: one is, that, if the water be foul, the mud, sand, and gravel, are not so apt to stick by the way in rising as if the barrel was a cylinder, equal in diameter throughout its whole length. And, by making the barrel a little conical, the iron hoops take the better hold, and draw the joints of the covering boards the closer. These boards may be of deal, for lightness.

The quantity of water that a screw-engine of this kind is capable of raising depends upon various circumstances, as the number of threads in the barrel, its size, elevation, &c. In general, an engine of two threads, eighteen feet long in the barrel, and elevated to an angle of forty-five degrees, will throw out all the water that springs up in a surface of from two to three thousand square feet; and keep a pond, or bottom of a lock or sluice, dry enough for men to stand in and repair it: this, however, is to be understood where the bottom and sides of the pond are of a pretty close soil; for, if the soil be sandy, gravelly, and porous, the water will force through such a soil too fast for one such engine to keep the pond dry. The eighteen-feet one is the largest screw-engine commonly made. The engines of this size are mostly worked with horses, proper-wheel work being fixed to the upper end of the shaft for that purpose: twelve horses are necessary to turn it, four each time, and sometimes even sixteen are employed by turns. There are frequently, however, smaller screw-engines made, to be turned by men, with a crank or bent handle, at which four or five men can work at once, changing every three or four hours. These answer very well where the water to be raised is in smaller quantity. By these engines water may be conveniently raised four, five, or even six feet, and thrown over banks or walls.

ARCHITECTURE *Rural*, that sort which relates to the œconomy of farm-buildings. See *Rural Architecture.*

ARDERS, a provincial term employed to signify fallowings, or frequent ploughings of land.

ARGILLACEOUS, any thing containing clay.

ARGILLACEOUS *Earth*, such soil as contains much clay.

ARGILLACEOUS *Marl*, is that sort of marl which contains a large proportion of clayey matter in its composition. See *Marl.*

ARM *of a Horse*, a term sometimes applied to the fore-leg. See *Fore-thigh.*

AROMATIC, an epithet applied to such plants, and other bodies, as yield a fine fragrant smell, and have a warm spicy taste.

ARPENT, the French name for an acre. It has been already observed under the head *Acre*, that the French arpent contains one hundred perches of twenty-two French square feet, which are equal to about one acre and three quarters of a rood English measure. But it may be necessary to add here, that the French have three different arpents, distinguished by the epithets *little*, *middle*, and *great*, arpent.

The *little* arpent contains one hundred perches of eighteen feet and a half square; consequently its superficial measure is 32,400 French feet, equal to 34,603 feet, or three roods seven perches and twenty-seven feet English measure.

The *middle* arpent consists also of one hundred perches, twenty feet square, which make 40,000 French feet superficial measure; equal to 42,720 feet, or three roods thirty-six perches and 149 feet English measure.

The *great* arpent contains one hundred perches of twenty-two feet each, or 51,691 square English feet. See *Acre.*

ARRANGEMENT *of Crops*, the method of adjusting or distributing the crops on farms of the arable kind, so as to render them the most advantageous, and, at the same time, the least injurious to the land. See *Farm and Rotation of Crops.*

ARRANGEMENT *of Farms*, the manner of disposing and laying-out the lands which they contain, so as to be the most convenient and beneficial both to the farmer and proprietor. See *Farm.*

ARRANGEMENT *of Trees*, the proper distributing of trees or plants in the forming of plantations, or other planted tracts of land. See *Plantation and Planting.*

ARRESTS, in *farriery*, denote a sort of mangey tumours on the sinews of the hind-legs of a horse, between the ham and the pastern, called also rat-tails. The name is probably taken from the resemblance they bear to the *arrests* or back-bones of fishes. They are sometimes called *Arrets.*

ARSENIC, a well-known poisonous mineral substance, which seems to have some affinity both to sulphur and to a semi-metal. It is contained in different proportions in most kinds of ores, as those of tin, bismuth, the white pyrites, and particularly *cobalt*; from which last the greatest quantity is obtained by being broken in pieces, and placed over a fire, the sublimed arsenic, resting on the sides of long chimneys designed for its reception, being swept off into proper vessels to be resublimed, or at least melted, by which it is formed into the white shining masses which are met with in the shops. It is chiefly brought from the mines in Saxony and Bohemia; but small quantities are sublimed in Cornwall, from the cobalt that is found there. Where there are large portions of sulphur, it is rendered nearly inert.

It is of different colours; as white, yellow, and red: the first of which is the strongest, and the last the weakest.

Pure *white arsenic* has a penetrating corrosive taste, and when taken into the stomach of an animal, is a violent poison. According to Mr. Boardman, "it produces speedy dryness in the throat, and inflammation, dejection, fainting, stupor, tremors, convulsions, palsy, thirst, burning in the stomach, gripes, cold sweats, hiccough, and at last death. Besides the effects which it hath in common with other poisons, it acts as a caustic on the coats of the stomach, and perforates the intestines, occasions a swelling and sphacelation of the whole body, and a sudden putrefaction after death. When the quantity taken is not fatal, it occasions tremors, palsies, or lingering diseases." It is added that, though there be but little hope after it is swallowed, yet, if assistance is had immediately, some advantage may in particular cases be obtained by the use of strong solutions of fixed alkaline salts and oil, in large quantities, as a pint or more at a time. When used in veterinary practice, as a topical remedy, it should be with great caution. It acts as a caustic when topically applied.

ARTIFICIAL GRASSES are such grasses as are introduced into field-husbandry, and cultivated either for the purpose of being made into hay or for being fed off by cattle. Clovers, lucerne, sainfoin, trefoil, burnet, ray-grass, spurry, and some others, are of this kind.

The common and almost general introduction or interposition of crops of this sort between those of the corn kinds is a practice of vast utility and importance, as the lands are in consequence not only prevented from being so greatly exhausted as would be the case under other circumstances, but, at the same time rendered proper for the growth of particular kinds of grain without the aid of fallowing, and a much larger proportion of green and other food than could otherwise be obtained is provided for the support of cattle and other sorts of live stock. It has of course been greatly advantageous in laying the foundation of the late improvements in arable cultivation as well as that of live-stock. It has been remarked by a late practical writer, that, "as most of the plants employed in this way are of considerable size and strength, or luxuriance of growth, they must of course, as well as the natural grasses, require the ground on which they are cultivated to possess a good state of fertility, and a considerable fineness of mould; as where this is not the case, they seldom succeed in a perfect manner, or afford that abundance of produce which would otherwise be the case. Like the natural grasses they should, he thinks, also be adapted to the peculiarity of the soil on which they are to be grown, as they are all found to answer better on some kinds of land than others. Some of them succeeding most perfectly on the heavier sorts of soil, as those of the more dry, loamy, clayey, and stronger gravelly descriptions; others on the more strong, poor, and thin kinds of calcareous lands, as those of the chalky and limestone sort; and others on the deep fertile grounds, which abound in vegetable matter." The culture of foreign or artificial grasses has been practised in some districts for more than a century; while, in others, it has only been attended to within these few years; and there are still others that have but just begun to introduce these kinds of grasses. Wherever they have, however, been properly cultivated, so various and so manifold have been found the advantages arising from them, that they form a very lucrative branch of husbandry, and are consequently raised in abundance in many parts of the kingdom. Those which are most usually propagated, and found to bring the most considerable profit to the farmer, are sainfoin or cinquefoil, clover, trefoil, hop-clover or nonsuch, and lucerne. One or other of these different species of grass may indeed be beneficially cultivated on almost every soil; as, where the poverty of the ground will not admit of sowing either lucerne or clover, sainfoin or trefoil, from their requiring a less depth of mould, may turn out a weighty crop. Sainfoin, clover, and trefoil, are now so universally raised from seed of English growth, that they have become in a manner naturalized to the soil, there being scarcely any country in Europe where larger burthens are grown than in our own. Lucerne, though it be sometimes reserved for seed here, is most successfully raised from seeds of foreign growth. In respect to burnet, spurry, and timothy grass, although their virtues have been highly celebrated by many, they have perhaps but seldom been found to answer in the cultivation in any degree equal to the sanguine commendations bestowed on them.

In the Agricultural Survey of Norfolk, it is judiciously remarked by Mr. Kent, that artificial grasses should be chosen agreeably to the soil. Sainfoin should be introduced where there is a chalky, marly, or even a gravelly, bottom.—White clover should be the principal grass where land is designed to be laid for a continuance. Trefoil and burnet, upon high and poor uplands, designed for sheep-walks. Perennial darnel, or what the farmers call rye-grass, is proper upon light arable land; for, though it is an exhauster, it serves better than any other to brace the surface. A few acres of lucerne he likewise recommends to every farmer who has a piece of loamy tillage near his house.

And Mr. Billingsley, in his Survey of the County of Somerset, says, that on the stone-brash and free-stone-grit soil sainfoin takes the lead; and, though the seed is very expensive, the quantity and quality

of its produce, together with its durability, make an ample return of profit, particularly if sown when the land is clean.

Next to sainfoin, rye-grass, marl-grass, and white Dutch clover, are in deserved repute when the land is intended to remain some years in grass; but, when it is intended to be ploughed again in the course of a year or two, broad-clover is preferred to all other artificial grasses.

It is likewise observed, in the able Survey of Northumberland, that few of the artificial grasses are ever grown alone, except red clover, when intended to continue only one year; and even then, a small portion of ray-grass, as from one to three gallons per acre, is generally sown with it; and, the writers suppose, with much propriety, as it not only comes early in the spring, but thickens the crop, and facilitates making the clover into hay.

But, when land is intended to continue for three or more years in grass, they are generally mixed in the proportion of eight or ten pounds of red clover, four pounds of white clover, and half a bushel of ray-grass, per acre: to the above quantities are sometimes added, three or four pounds of rib-grass, and hopmedic, as the soil suits.

After informing us, that the prejudice that prevails almost universally in Westmoreland against the cultivation of clover and rye-grass is a great obstacle to the improvement of the husbandry of the county, and must be overcome before the arable lands can be brought to that degree of cultivation of which they are susceptible, the same author, in the Survey of that County, remarks, that it is said that hay made of clover and rye-grass is much coarser than that which is made of the natural grasses; and that these artificial plants, giving place to the natural ones, perish at the end of two or three years, and therefore ought never to be sown at all. The opinion is conceived to be ill-founded, which holds, that hay made of sown grasses is bad in quality, long experience and continued practice having shown that horses are very fond of such hay, and that, when even fed upon it alone, they are able to do a great deal of hard work. It can hardly be seriously asserted that hay made of the trash produced spontaneously by the land, the two first years after it has been cropped with corn, is better than hay made of clover and rye-grass. The artificial grasses seldom or never perish at once at the end of either the second or third year; they disappear gradually, making room for the natural herbage to occupy their place, which it is imagined it would be found upon trial to do with much more profit to the farmer than would have accrued to him by managing his lands in the ordinary way; for the superior value of the hay the first two years would far more than reimburse him for the expense of the grass-seeds, and he might still have his favourite natural hay after these had died entirely out. This is stated upon the supposition that the field was to be allowed to lie eight or ten years in grass, as is the custom at present. If it were to be broken up at the end of the first or second year, it would be found in good condition for bearing a crop of corn, the roots of clover, it is well known, being a great improver of the soil.

In the year 1792, Mr. Smith, at Henridding in the parish of Burton, we are told, sowed a close, containing exactly two acres and a half, Lancashire measure, with 48lbs. of red clover-seed, amongst a crop of barley, for which the land had been slightly manured after fallow wheat. This field is in Lancashire; but being situated within an hundred yards of the county of Westmoreland, it may be mentioned, the author says, without impropriety; and it is selected merely because the particulars respecting it are better known to the writer of the report than those in regard to any field of clover in the county that was the object of his survey. It was mown in the month of July 1793, and it then yielded a crop of twenty-two single-horse cart-loads of hay. It was mown a second time in September, and produced eighteen of the same cart-loads. It was depastured with nine sheep from the time the last crop was carried off till the beginning of November, and the foggage was then tolerably good. Let, says the surveyor, the most strenuous advocates for natural grass say, whether they ever had a crop so valuable!

Where the land is intended to be depastured, the argument, he observes, will apply with treble force; and the decided preference given by cattle of all kinds to the green herbage of the artificial over that of the natural grass kind ought to remove every doubt from the minds even of those who are the most strongly prepossessed in favour of the present practice.

In front of Carns Wilson, Esq's. new house, near Kirkby Lonsdale, in the same county, there lies, the writer says, a field of sixteen acres, which was sown with grass-seeds amongst a crop of barley in the year 1792. It was depastured in 1793, and maintained three times more stock than he would have expected it to maintain had it been left to itself in the ordinary way. Farmers, the most prejudiced against sown grasses, it is observed, saw and confessed the force of the experiment, and, it is not to be doubted, will follow an example which tends so materially to promote their interest.

In order to draw any fair comparative value between the produce of old grass-lands and artificial grasses, the soil and situation ought to be exactly alike, and the experiments be accurately conducted. For want of such data, no just conclusions can be made; but we believe that general observation and experience have established an opinion, that the same lands which, in a state of old grass, carried three sheep an acre, will, for the first year of clover and rye-grass, depasture five or six; on rich old grazing pastures, the difference will probably not be so great, and what they fall short in summer will be made up by their superiority in winter. On clayey soils, it would certainly be a dangerous experiment to convert those rich grazing pastures into tillage, as a certain portion of such is a valuable acquisition to every farm: but they are so rarely scattered, that few farms are so fortunate as to enjoy so desirable an appendage.

Artificial *Pastures* are such pasture-grounds as have been cultivated and sown with plants of the kind described in the preceding article, or such others as yield a great quantity of food for cattle.

Mr. Donaldson, in his Modern Agriculture, says,

that the ancient meadows and pastures in England, in place of being sown out with grass-seeds, were formerly, like the out-field lands in Scotland, committed to nature's charge. She, in time, bountifully stocked them with such grasses and weeds as were natural to the soil, or as were carried thither by the winds from the adjoining fields. In too many instances, this practice, improper as it evidently is, has undergone little improvement in modern times. It is true, when it is now proposed to lay out a field with a view of its remaining a great number of years in grass, it is much better cultivated and prepared, and art, as well as nature, is employed to stock it with plants. Botanical writers on husbandry have been at great pains to describe all the various sorts of grasses found in natural pastures. But, says he, if we examine the practice of those who are the greatest advocates for permanent pastures, we shall find that the seeds commonly sown are a mixture of rubbish scraped together from a score of different hay-lofts, and sold by the London seedsmen under the denomination of hay-seeds, or they are collected by the farmers themselves from their former year's stock of hay. In respect to the insufficiency of these seeds, and the little dependence which the farmers place on them, it may be stated, that from eight to ten, sometimes twelve, bushels are sown on the English acre,—a quantity much greater than would be necessary were it expected that even one-third would vegetate. When it is considered to what an extent all the meadow-hay in England is heated in the stack, it is obvious the vegetative powers of these small seeds must be greatly injured, if not entirely destroyed. Besides, as the meadows and old pastures contain a great variety of grasses, and as the hay, not the seeds, is the object of the farmer's attention, a few of them only, and these probably of the very worst sorts, may have arrived at maturity when the crop was mown: further, it may be observed, that different soils produce naturally different plants, and of course, if the seeds of grasses which grow naturally on a dry light sandy soil be sown on strong loams, there is little chance of the land being fully stocked with useful plants, at least for some years. All these circumstances considered, it is certainly matter of surprise that the English farmers do not more generally substitute rye-grass, white and yellow clover, &c. in place of this composition of they know not what.

And Mr. Boys, in his able Survey of the County of Kent, says, that for laying land down to pasture, the common practice is to sow hay-seeds, which are the sweepings of hay-lofts, procured in London at from 10*d.* to 1*s.* 3*d.* per bushel; these are sown in the quantity of about ten or twelve bushels per acre, and ten or twelve pounds of white clover seed, under barley, on land that has been made perfectly clean by a summer-fallow. By this mode it frequently happens that very bad sorts of grasses are raised, and the farmer's hopes of a good pasture are totally destroyed. It is, therefore, a much better method, and indeed the only good one, until the best sorts of grasses are cultivated for sale, to save for seed a piece of fine old meadow, that is known to abound in the best sorts of grass, by letting it stand about three or four weeks longer than it should, when intended to be mown for hay. When it is mown and ripe, let it be thrashed on a sail-cloth in the field, and immediately sown on the piece of land intended for the new pasture; which should, by a good summer-fallow, be brought into fine tilth to receive the seed. This, with ten or twelve pounds of white clover, will make an excellent meadow or pasture.

When a field is laid down to grass for three, four, or five years, says Mr. Donaldson, the farmer has generally two objects in view, namely, to make the first year's crop into hay, and to pasture the field afterwards, so long as it remains unbroken up. In order to increase the quantity of hay, a few pounds of red clover are generally sown with the other seeds, which would not happen, if it were intended to pasture the first year's crop. Rye-grass is always sown, whether hay or pasture be the object; and although some writers describe it as a very bad grass, yet the practical farmer appears satisfied that the contrary is the case, or at least that there are no others of that tribe of grasses which he can cultivate to so much advantage, either for hay or pasture, especially if the pasture be kept fully stocked in the early part of the season. The other seeds commonly cultivated for pasture, are white and yellow clover, and rib-grass. White clover, besides being the sweetest and best food for every species of live-stock, possesses the superior quality of being a permanent plant. As it does not grow to a great height, but rather spreads on the surface, it therefore forms a closer sward than any other of the cultivated grasses; and, on that account, is always sown on fields intended for pasture. The allowance of seed is regulated by the kinds and quantities of the others sown at the same time, but may be reckoned from four to eight pounds the English acre. This species of grass is cultivated on every sort of soil, but thrives best on that which is of a dry and friable nature. There is but a small quantity of white clover seed saved in England, and the instances are very rare where it is attempted in Scotland. The yellow or hop clover is also a plant natural to this country, and to be found in all pastures where the soil is dry and light. It possesses the property of continuing long, and another of no less importance, that of thriving on soils of the lightest nature. It commonly forms a part of the mixture of grass-seeds sown on lands intended for pasture, and three or four pounds to the acre is the ordinary allowance. Rib-grass is likewise a sort of grass now very much cultivated in Scotland, as well as in several districts in England. It is an herbage of which cattle are extremely fond, and it is said to be equally good, both for fattening cattle, and for milch cows. From four to six pounds are sown on the acre. It is an indigenous plant of this country, and frequently abounds in old rich pastures. These are the grasses most commonly cultivated under what may be called the modern system of grass-husbandry; the advantages of which, beyond what can be derived either from allowing a field to provide itself with grasses, as was the ancient practice, or from sowing a confused mixture of seeds, the qualities and properties of which are but little known, are scarce to be conceived, except by those who have adopted the practice.

There are unquestionably many grasses now growing as neglected weeds, which, by proper care and attention, might, in time, be added to the list above mentioned, and with great advantage to the practical farmer; but till that be done, and their usefulness proved by experience, the farmer will do well to sow the seeds of grasses that have been regularly cultivated, and of the value of which he has had undoubted proofs.

Artificial *Ponds*, are such ponds as have been formed in particular ways by means of art. See *Drinking Ponds* and *Ponds*.

Artificial *Pools*, such as are formed by art, for the purpose of affording good water for different sorts of live-stock. This method of collecting and providing water, seems to have been had recourse to at an early period, as is obvious from basons and reservoirs for the purpose, being found to prevail about the scites of old farm-houses, in many districts of the kingdom. And it is a practice which is still made use of with advantage in all dry situations where water is scarce. See *Drinking Ponds*.

Artificial *Shelter*, that sort of shelter which is produced by the judicious disposal or planting of timber or other trees, which may be done in belts, zones, or other methods, according to the particular nature of the situation, and with different sorts of plants, so as to suit the nature of the soils. It is highly useful in exposed situations, both for arable and grazing lands. See *Planting*.

Artificial *Springs*, such as are made by art, in imitation of those of the natural kind. They may be made use of for the purpose of supplying farm-houses and offices in different dry parts of the island with good water for live-stock, especially where the situations are favourable, as that collected from the roofs of the buildings is never so well tasted. Mr. Marshall suggests, that this may be effected by arresting the water that has passed down through the soil of grass-lands above such buildings, in covered under-drains, properly clayed and dished at the bottoms, and filled in a partial manner, with gravelly, or other porous materials, through which it may percolate, pass down, and be conveyed into cisterns constructed for the purpose, in the farm-yards, or other convenient places. In this way he supposes the palatableness of spring-water and the wholesomeness of that collected from the atmosphere, may be combined.

Artificial *Streams*, such as are formed and directed by art, for some useful purpose in rural œconomy. It is in but few situations that this sort of improvement has been laid hold of with the view of applying it to agricultural uses. The author of the Rural Œconomy of different Parts of the Kingdom, however, conceives, that "in mountain-skirt situations, on the lower stages of hills, and wherever water can be commanded, much improvement remains to be effected" in this way, by diverting and leading the natural streams to the unwatered grounds below them. By this mode, numerous villages, farmsteads, and pasture lands, may be supplied with water, as well as extensive tracts of arable and meadow-grounds be subjected to the beneficial practice of irregation. On large intire estates, thus favourably situated, vast advantage may, he thinks, be derived in this way to the different farms into which they are divided.

Where streams or brooks can be spread over a large extent of country in which properties are greatly divided and intermixed, it is suggested by the same writer, that the assistance of Parliament should be had recourse to; and after an act has been obtained, commissioners appointed for directing and settling the distribution of the water in such a manner as may be the most suitable and advantageous to the persons concerned; as well as for adjusting all other circumstances and disputes.

Or, in cases where the proprietors are unanimous, and not numerous, they may be sufficient for these purposes without the trouble and expense of an act of Parliament.

It is further observed, that not only uplands are capable of admitting of this sort of improvement, but even low lying vale marsh and rich grazing-lands. In this sort of business, it is not, he supposes, necessary for each homestead, pasture-land, field, &c. to be supplied with a continual stream. If the supplies be small in comparison to the demands, they may be distributed in turns to the farms, fields, &c. according to circumstances. The cattle-drinking places should also be proportioned to the quantities of water. In continued streams, the live-stock may drink at the dilations of them, or at troughs placed properly for the purpose. And where the supplies are only occasional, ponds, basons, and reservoirs, filled from time to time, may be sufficient. In distributing it over lands, various circumstances must be considered. See *Watering*.

ASCARIDES, in *farriery*, small needle-shaped worms, of a white or azure colour, with flattish heads, common in horses. From their form, they are often called needle-worms by farriers.

These worms are extremely troublesome, and difficult to be eradicated, and expose horses to frequent fretting uneasy disorders in the bowels. They breed at all times of the year, and often when one brood is destroyed, another succeeds. They are not dangerous: but when horses are pestered with them, though they may go through their business tolerably well, and sometimes feed heartily, they always look lean and jaded; their hair staring as if they were surfeited, and nothing they eat makes them thrive. The circumstances which generally denote the presence of these worms, are the horses frequently striking their hind feet against their bellies, and appearing to be griped, but without the violent symptoms that attend a colic or stranguary; not rolling or tumbling, but merely showing uneasiness, and laying themselves down quietly on their bellies for a little while, and then getting up again, and beginning to feed. The surest sign, however, is the seeing of them voided with the dung.

Worms, however, sometimes come away in great numbers by a purge, and some horses get clear of them by that means only; but this does not often happen, as horses that breed ascarides, are, of all others, probably from some local debility in the bowels, the most subject to slime and wormy matter. They seem to have their principal lodgment about the beginning of

the small guts, near the stomach, as is evident from their appearances, the symptoms of the gripes, and the sudden fits of sickness which such horses are seised with. They are seldom observed, except when horses have had purges given them, or when they fall into natural purging, which such horses are subject to. They not only make horses grow lean, and look surfeited, but in opening their mouths one may perceive a more than ordinary languid whiteness, and a sickly smell, arising probably from the want of those due supplies of blood and nourishment, which give a liveliness to the colour that is always perceivable in sound vigorous horses; so that whatever may be the primary cause, these worms seem, in a great measure, to proceed from a vitiated appetite, and a weak digestion, which renders them the more difficult to be removed. On this account, recourse should first be had to mercurials, and then to such things as are proper to strengthen the stomach, promote digestion, and give more tone to the solids.

The following method may be tried in order to remove such worms:

"Take of calomel, two drams; conserve of roses, half an ounce; make them into a ball, with a sufficient quantity of some testaceous powder, and give it in the morning, keeping the horse from meat and water two hours before, and two hours after taking it."

The next morning the following purge may be given, taking great care to keep the horse from being wet, or from any thing that may expose him to catch cold:

"Take of soccotrine aloes in powder, one ounce; root of jalap in powder, one dram and a half; salt of tartar, two drams; fresh ginger grated, two drams; oil of savin, forty drops; make the whole into a ball with flour or liquorice powder."

This purge may be worked off in the stable with warm water, which is much the safest way when mercurials are given. The ball and purge may be repeated in four or five days; and occasionally afterwards.

After this course, the following drink may be given and continued until the horse begins to thrive and look healthy:

"Take of gentian root, zeodary and galingals bruised, each one ounce and an half; Peruvian bark bruised, two ounces; chamomile flowers and tops of centaury, each two handfuls; juniper berries, four ounces; infuse them in two gallons of ale for eight or ten days, shaking the vessel frequently. A pint of the liquor may be administered night and morning."

Considerable advantage has likewise been derived, in some cases, from the use of the following remedy:

"Take of tin in fine powder, and sulphurated quicksilver, each half an ounce; mix them together, and give them every night, either in a mash or in the ordinary feed. And the giving of an ounce of steel finely powdered every day, for a fortnight, in the corn, has been sometimes attended with beneficial effects."

ASH, *or* ASH-TREE, a sort of timber-tree much cultivated in some places on the more dry descriptions of land, where, in general, it thrives in the best manner; of which kind there are several species, grown by curious persons for the sake of variety, or for the purpose of ornamenting pleasure-grounds; but that sort which chiefly deserves attention here is, the common ash, so well known by the farmer as to need no description.

According to Mr. Nicol, it "most affects a sandy or gravelly loam, and is there found of highest perfection and value as timber. Nevertheless, it grows freely on all soils, except a stiff clay with a hard retentive bottom. In rich lands its wood is short and brittle; but on sand or gravel it is tough and reedy, which constitutes its greatest value. In the former case, also, it goes soon to decay, by overgrowing its strength; but, in the latter, it will live and flourish to a great age."

This sort of tree propagates itself plentifully by means of seeds, which being scattered in autumn in places where cattle do not come, plenty of plants come up in the spring. When any person is, however, desirous of raising a quantity of these trees, the seeds should be sown as soon as they are ripe, and the plants will then come up in the following spring; but if the seeds be kept out of the ground till spring, they will not come up till the year after; the ground therefore should be kept clean all the summer, where they are sown, and not disturbed, lest the seeds should be turned out of the ground, or buried too deep to grow.

When the plants are come up, they must be kept clean from weeds during the summer; and, if they make good progress in the seed-bed, they will be fit to transplant by the following autumn; some ground should, therefore, be prepared to receive them; and as soon as their leaves begin to fall, they should be transplanted. In taking them up, care should be taken not to break or tear off their roots; to prevent which the work should be performed with a spade, and not drawn up, as is frequently practised; for, as many of the plants which rise first from seeds, will outstrip the others in their growth, it is a frequent practice to draw out the largest plants, and leave the others to grow a year longer, before they are transplanted: and to avoid hurting those that are left, the others are drawn out by hand, and consequently many of their roots torn off, or broken. It is, therefore, much the better way to take all up, little or big, together, and transplant them out, placing the large ones together in rows, and the small ones by themselves. The rows should be three feet asunder, and the plants a foot and a half distant in the rows. In this nursery they should remain two years, by which time they will be strong enough to plant out where they are to remain, as the younger they are planted out the better they will grow; so that where they are designed for use, they should be planted very young; nor should the ground where they are raised be better than that where they are designed to grow. For when plants are raised in good land, and afterwards planted into worse, they very rarely thrive; on which account it is much the best method to make the nursery upon a part of the same land where the trees are designed to be planted, and then a sufficient number of the trees may be left standing upon the ground, which will generally outstrip those which are removed, and grow to a larger size.

Where planters reside in the neighbourhood of ash-trees, they may supply themselves with plenty of self-

sown plants, provided cattle are not suffered to graze on the land; for if they can come at them, they will eat off the young plants, and not suffer them to grow. And where the seeds fall in hedges, and are protected by bushes, the plants mostly come up and thrive well: in such hedges the trees are frequently permitted to grow till they have destroyed the hedge, for there is scarce any tree so hurtful to all kinds of vegetables as the ash, as it robs every plant of its nourishment within the reach of its roots; it should therefore never be suffered to grow in hedge-rows, as the hedge is not only killed, but corn, or whatever is sown near it, greatly impoverished. Nor should any ash-trees be permitted to grow near pasture-grounds; for if cows eat of the leaves or shoots, the butter that is made from their milk will, it is asserted, be rank, and of little or no value. In all good dairy-countries, therefore, they never suffer any ash-trees to grow in their pastures. The truth of this fact is, however, to be disputed, as there is no taste in the leaves of these trees that render it probable.

If a wood of this kind of tree be rightly managed, it will turn greatly to the advantage of its owner; for by the underwood, which will be fit to cut every eight or ten years, there will be a continual income more than sufficient to pay the rent of the ground, and all other charges; and still a stock will be preserved for timber, which in a few years may be worth forty or fifty shillings per acre.

The ash-tree will thrive in barren soils, and in the bleakest and most exposed situations; but it grows to the greatest advantage on such lands as have a tolerable depth of soil, and on which water is not liable to stagnate. It is found to be of so hardy a nature as to withstand the effects of the sea-winds; it may, therefore, be planted on the coasts where but few kinds of trees are found to prosper. When planted on the sides of ditches, or in moist meadow-lands, from the spreading of its roots, it has been found to render the ground more firm and dry. From this, as well as other causes, it is, however, highly prejudicial when planted on arable land; it ought to be chiefly planted in waste nooks and corners of fields, or, perhaps, on improveable swamp lands, and on the springy sides of hills, as it would not only render them useful as plantations, but, from the spreading of its roots, make them more firm.

In the sixth volume of the Bath Papers, Mr. South observes, that the growth of ash, in soils adapted to its nature, is little inferior to that of elm or beech; but that there is no timber whatsoever that differs more in its value than this does, according to its situation. The productions of dry and healthy ground will prove acceptable to most purchasers. Those of woods are generally clean in the shaft, free-cleft, and more valuable than the former. The nearer the ground, the tougher is the timber; the shaft therefore is coveted, the brittle-branch rejected; the buyers of this timber accepting the shaft and its continuation, or best bough; the rest, be they ever so large, go with the top.

If these trees are removed when ten or twelve feet high, their grain acquires a degree of tenacity very prejudicial to the timber. My predecessor, says he, about the year 1750, planted a row of them in a place since converted into a garden: their shafts were apparently so clean as to engage a cooper's notice, who purchased them at a good price, *viz.* 36*s.* per ton, but told me afterwards, they were clung, and did not answer his purpose, so he re-sold them to a country carpenter at a loss. One of these trees, which was left standing, measures now four feet eight inches in circumference, at four feet from the ground.

Ash-timber, when raised in damp meadows, or moorish soils, becomes light, spongy, brittle, and of small value, in comparison of that on dry and healthy spots. In meadows, they will attain a size which cannot be expected in moors and bogs; for when the roots reach the peat, the bark grows mossy, and the top decays; how long stubs may be productive of poles, in such situations, remains to be determined; but experience convinces him, that ash, thus planted, will never become timber of any value, as the roots must perish before the tree arrives to perfection.

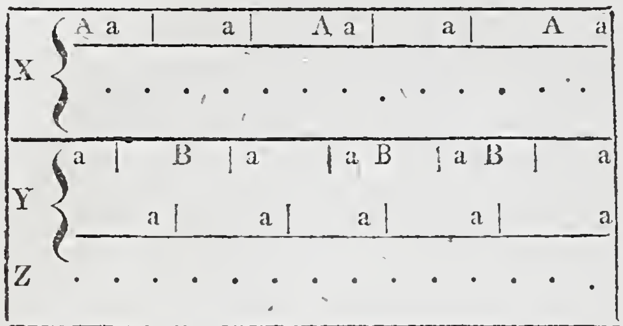
Ash-trees, when mixed with beeches in an open grove, run to great lengths, are free-cleft, and make valuable timber. Coach-makers, wheel-wrights, &c. prefer the shafts when a little bent more than when perfectly straight. The cooper has no objection to the latter.

And in the fifth volume of the same papers we find the following mode of planting ashes for hoops, laths, fencing, and what is termed post and billet for collieries, pursued in Warwickshire on the declivity of a poor hill, which was wet and springy. As the hill was to be drained, a line in the direction of the hill was drawn from the top to the bottom of the ground intended to be planted; the ash-plants of three year's old, having their tops and roots so cut as not to exceed eight or nine inches in length, were laid horizontally on the ground at the distance of three feet and an half, the top part of each plant projecting about half an inch beyond the line: then the labourer, beginning at the lower end of the plantation, that the water may drain off as he goes on, and standing with his back to the hill, with his spade digs the earth from the line on his right to the distance of twenty-one inches; on his left, to the depth of twelve or fourteen inches, or what he may think sufficient to carry off the water, and effectually to cover the roots of the plants. He then removes the line in a parallel direction three feet and an half from its former place, lays the plants in the same order as before, and digs out the remaining twenty-one inches to the same depth as before, and throws it on the left-hand bed. Thus a ditch of three feet and a half wide is effected; and as each plant is three feet and a half asunder in the beds, and the ditch is of the same width, each plant has a space exactly three feet and a half square to extend itself in. Then the line is again removed three feet and an half further to the left, when the same process again takes place. Care, however, should be taken that the plants never be laid immediately opposite to each other, but one opposite the opening between two others, thus:

*   *   *   *   *   *
  *   *   *   *   *

This process may probably be better understood by the remarks and representations contained in an-

other paper of the same work, in which it is observed, that the labourer is simply to throw one half of the ground taken out of the ditch on one bed, and one half on the other, as in the following sketch:



Where the dotted line X divides the trench or ditch into two equal parts, one half of which is thrown on A, the other on B: Y the bed on which the ash-plants are laid horizontally: a a a are the ash-plants laid horizontally. Z the ditch as before.

When the land to be planted is dry, and not boggy, it is recommended to make the beds at right angles to the hill, or at least oblique; by which method the beds may retain as much of the moisture that falls as they can (without being stagnant), which is peculiarly grateful to ash. It would be also desirable to extend the distance of planting the ashes from three feet and an half, as specified above, to five feet, or at least four feet and an half; because, though not more than two or three poles may arise from each root for the first fourteen years, three times the number will probably be the quantity at the end of the second period, which will have but bare room in five feet space.

In this mode of cultivation, it is remarked that not only the land is effectually drained, but the plants have also a double portion of vegetable earth, and are thereby enabled to force their horizontal roots rapidly through the bed. Inexperience may perhaps object, that the plants being laid horizontally will not make perpendicular shoots; but nature gives them a perpendicular direction, lay your plants in what mander you please. After planting, no further attention is required but to cut off any crooked or straggling shoots, and to hoe the plants for the first four years: the fences also must be well secured. Timber-trees may be planted to advantage in the middle of the beds, in squares of fifty or sixty feet; and, if oak, may probably arrive at maturity by the time the stocks begin to fail.

In this way of planting, the average price of each acre in Warwickshire, when cut at fourteen year's growth, was 70*l.*; though the boggy part of the land, before this mode of cultivation, was not worth a farthing. From the stocks or stumps, when cut, a larger crop accrues the next fourteen years; and so on, perhaps, for more than a century. After each cutting, it is proper to cover, or rather to earth up, the old stocks with the mould that may have fallen from the sides of the beds into the ditches. The usual price of planting and fencing with quicksets is not more than 8*l.* or 9*l.* per acre.

If ash-trees get disbarked, though in appearance they should be flourishing on being felled, the roots will frequently be found decayed, and the stems at the bottom a complete shell; they therefore ought not, in point of profit, to be suffered to stand. These trees, when they stand among firs and larches, if planted close, will grow too tall and slender, but thrive well when planted alone. They are frequently known to have thriven for at least ninety years, as may be seen by their rings. In the first ten years, as well as the last, the growth has been observed to be slow.

It is remarked by Mr. Marshall, in his Rural Economy of the Midland Counties, that, in the intermediate years, the different thicknesses of the rings in different years were striking.

This kind of timber is generally esteemed next in value to that of the oak, and in some places even nearly equal to it. It is of great use to the coach-maker, the wheel-wright, and cart-wright, for ploughs, axle-trees, fellies of wheels, harrows, ladders, and other implements of husbandry; and also for oars, blocks for pulleys, and many other purposes.

Mr. Nicol also states, that "no tree in the forest comes to be of use so soon as the ash. It possesses the singular property of perfection in infancy! From the day its stem is three inches in diameter, the wood is equally durable until it be three feet, or any size or age whatever." It is likewise excellent as fuel whether green or when dry.

The best season for selling these trees is from November to February; for if it be done either too early in the autumn, or too early in the spring, the timber will be subject to be infested with worms and other insects; but, for lopping of pollards, the spring is preferable for all soft wood.

The ashes resulting from the combustion of this kind of wood are found to contain good pot-ash in a pretty large proportion.

Great attention has lately been paid to the planting of this useful timber-tree in different parts of the kingdom. Near Great Finborough in Suffolk, Mr. Wollaston has planted twenty acres; and at Butsfield, near Durham, Mr. White has covered thirty-five acres. In Kent, a still larger extent of land has been planted by Mr. Day, of Frindsbury; and at Buscot, near Farringdon, Berkshire, Edward Loveden Loveden, Esq. is said to have planted thirty-three thousand on seven acres and nine perches. In Staffordshire, six thousand have been set by Mr. Sneyd, of Belmont; and in Westmoreland, the Bishop of Landaff has planted eleven acres with twenty thousand.

In Scotland, likewise, something has been done in the cultivation of ash-timber. In Cromarty, forty-two thousand have been planted by Mr. Ross; and fifty-seven thousand by the earl of Fife, in the county of Murray.

ASHES, the earthy and other particles of combustible substances after they have been burnt.

Their beneficial effects as manures may probably, in a great measure, arise from the portion of alkaline saline matter which they contain; which, by its agency on, and combination with, the materials that are present in soils, may render them more soluble and proper for the nutrition of plants.

Bleacher's Refuse or ASHES, are matters that con-

sist principally of the hard and undissolved parts of pot-ash, kelp, weed-ash, and barilla. Laid on alone, they are too stimulating; they ought, therefore, never to be used but with earth, or earth and dung: they answer well with blood, garbage, and putrid animal substances. They are generally laid upon fallows for wheat. The greatest advantage derived from them is upon clay or deep loams. Upon rushy grounds, or coarse wet meadows, they will be found particularly useful in destroying such coarse plants.

Coal-Ashes, probably from their containing a portion of calcareous matter, are found to be beneficial to stiff and sour lands, for which purpose they are successfully used in the neighbourhood of many great cities, where coal is burnt for fuel. They also open the texture of clayey grounds, and correct their tenacity and other bad qualities. The gardeners and farmers about London know their value, and make a very profitable use of them, particularly in bringing into order those grounds which have been dug for brick-earth. After spreading these ashes upon the clay bottom, they either sow horse-beans or set the early Spanish, and sometimes the Windsor-bean, in such spots; or else they lay such lands down with rye-grass, which generally succeeds well. Mr. Bradley long ago blamed the people of Staffordshire and the counties adjoining, where there are coal-pits, for not improving their heavy grounds around them by manuring them with coal-ashes, which might be easily burnt out of the waste coals of such pits; and "that, wherever there are plenty of coal-pits, there can be no want of good profitable land."

And Mr. Mortimer agrees with Mr. Bradley, in esteeming sea-coal ashes as the best manure of any for cold lands, as well as the most lasting, and the fittest to kill worms. Mr. Worlidge likewise looks upon them as an excellent compost when mixed with horse-dung; and remarks, that they are a great curer of moss and rushes in moist grounds.

This kind of ashes are employed in different proportions in different places, according to the particular circumstances of the crop and the land on which they are applied. It is observed by Mr. Farey, in the twenty-fifth volume of the Annals of Agriculture, that, in the vicinity of Dunstable, they are used at the rate of from fifty to sixty bushels to the statute acre, for a complete dressing; and that they succeed well sown on clover in March or April, on dry chalky lands. They also do much good, he says, to sward land, when applied during any part of the winter or spring; but they are never used on wheat. It is likewise further remarked by the same writer, that in very dry seasons they do little service, except on cold sward, which they invariably improve; and that on light land they require rain after being sown, in order to set them to work.

Peat-ashes are found, from long experience, to be a very good manure.

It is observed by Mr. Donaldson, in his View of the present State of Husbandry in Great Britain, that, in many parts of the kingdom, peat-earth, cut and dried in the course of summer, is the only fuel; and that the peat dug from the mosses, that are so firm as to bear cattle to tread on, is the best, both for fuel, and afterwards for manure. The ashes of what is pared from the surface of heaths and commons, by the cottagers in many parts, as about Bedford, are, he says, of little value, compared to those above-mentioned. It is probable that Berkshire is the only district of Great Britain, where peat-ashes, without mixture of any other substance, are at present generally used as manure. The ashes of peat, dug from extensive meadows in that county, have been proved, by the experience of sixty or seventy years, to be a most excellent manure, when used as a top-dressing on almost all kinds of crops; as oats, wheat, barley, turnips, clover, sainfoin, meadows, pastures, &c. The quantity used is about twenty bushels, more or less, as the condition of the land seems to require; and the price about 3*d.* or 4*d.* the bushel. To such an extent is this mode of manuring carried on in that county, that the proprietors receive two or three hundred pounds the acre, for a liberty of cutting and carrying off peat to the depth of five or six feet. It would be absurd to suppose, says he, that the peat-ashes of Berkshire are superior, as manure, to those in every other part of the island; and as their effects in that county, when applied to the soil, have been conspicuous for a great number of years, it is certainly a circumstance meriting the attention of those who reside where peat is the only fuel, to ascertain whether peat-ashes in such districts do not possess all the fertilising qualities of those in Berkshire. The experiment is easily made: all that is necessary being to keep the ashes dry, and under cover during winter; and to sprinkle them with the hand over the crops in the spring, and at the rate above mentioned.

The earl of Dundonald, however, remarks, that the ashes procured from peat, in the neighbourhood of Reading in Berkshire, seem to possess a fertilising power infinitely greater than ashes obtained from most other peat. They certainly contain no alkaline salts; and in an hasty analysis made about nine years since, no saline matter, says he, is recollected to have been got from them, but a small proportion of Epsom salt. Had these ashes, however, been analysed with more care, and when newly made, they probably would, he thinks, have been found to contain a hepar of lime, a salt which is soluble in water; whilst gypsum, to which it reverts on exposure to the air, is insoluble. To this hepar may the fertilising power of these ashes therefore most probably be ascribed.

And Mr. Middleton, in his Survey of the County of Middlesex, observes, that as the hills on each side of the meadows which produce the Newbury peat-ashes consist of chalk, easily dissolvable by heavy rain, which washes it off the ridges, down the furrows, ditches, and streamlets, to the low grounds, where, mixing with the floods, it is floated over the meadows, and deposited in the peat,—consequently, that the peat of that district differs from that of most others, by the quantity of chalk which it contains; and that, when dug, dried, and burnt, the fire reduces the chalk to lime, and the rest to ashes. Hence Newbury ashes are a mixture of lime and vegetable ashes; and it is, says he, very probable, that any common peat-ashes, or the ashes of rough grass-land, of turf, heath, furze, ling, wood, &c. produced by the operation of paring

and burning, being mixed with chalk-lime in due proportion, would be equally fertilising as these noted ashes.

It has been long since also observed by Mr. Miller, that these ashes are greatly bettered by being mixed with lime before they are laid on the land.

These ashes are produced from land that is black and crumbly at top, under which lies the peat, to the depth of several feet. They do not burn the peat in the field for ashes, by choice, because the peat is burnt for the ashes when it cannot be dried sufficiently for sale; and then it is burnt in large heaps, with a smothering fire; as is likewise the superficial black earth or moory soil, together with the refuse of the peat: the ashes of these are laid up in round or long heaps, rising at top like the ridge of a house, in order to throw off the rain, and keep them dry, till they are sold. Sometimes they are laid under dry sheds, or in houses, to save them from wet, which they cannot be wholly protected from by laying them up in ridges exposed to the weather, into which the rain penetrates for some inches deep; and these ashes are never so good manure as those that are kept dry. Near the surface of the peat-earth, there is sometimes a bed of whitish earth, called maum, which is a composition of earth and very small shells of the periwinkle kind: this is also burnt to ashes for manure; and the quantity of it in some places is so great, that the ashes are of a whitish colour, while those from the peat or moorish earth, are reddish. The white ashes are esteemed to be as good manure as the red: and being a kind of shell-marl, would make good manure without being burnt: as indeed they rarely are thoroughly, though they seldom lay them upon land, till they have passed the fire, or are mixed with the ashes of the peat-earth. The ashes of the peat sold for fuel, and burnt in chimnies, are much stronger manure than the ashes burnt in the field; and if care be taken to keep them dry, are sold for nearly double the price of the field-ashes.

Mr. Farey has found the field-ashes to greatly improve the chalky soils about Dunstable; but on the wet lands, or cold swards, and hot sandy lands, they did little good. They may be employed on the same kinds of crops, and in the same way, as coal-ashes; and also on the wheat-crops about April.

And Mr. Middleton observes, that he has tried the Newbury peat-ashes on wheat, tares, seeds, and meadows, in various quantities to the acre, without their producing any sensible effect.

In Norfolk, ashes are not in estimation as a manure; even those of the hearth are in some degree neglected. But the meadows and fens abound with peat-bogs, which in some places would be considered as inestimable sources of manure. And the peat-earth in such meadows, when burned, would no doubt afford an ample supply of ashes.

In many districts, much advantage has been supposed to arise from the practice of mixing lime with peat-ashes before they are applied to the ground.

M. Du Hamel has given an account of a kind of peat-ashes made in France, in the fifth volume of his Traité de la Culture de Terres.

The peat from which they are formed, he says, is a blackish earth, resembling the soil of some meadows. When burnt, it emits a thick, disagreeable, sulphureous vapour. A certain degree of moisture helps to make it burn, though even then it wastes but slowly. After it has once taken fire it burns of itself, but without producing any flame. It is of so caustic a nature, that it would strip off the skin of the hands and feet of the men who knead it, if they did not take proper precautions against that inconvenience. Its ashes retain this caustic quality; for the hands of those peasants who strew them are often hurt by it, if the air be at all damp. This earth, in its natural position, runs in veins of different sizes; sometimes seven or eight feet thick, and thirty or forty feet long; and sometimes they extend four or five hundred feet: after which the vein often fails at once, and perhaps is not found again for the distance of two or three miles. These veins generally lie pretty near the surface of the earth, seldom deeper than twelve or fifteen feet.

This earth is found only in marshy places, which must sometimes be drained before it can be got. It shows itself, he says, by a slimy skin upon the adjacent waters.

Three pounds of this earth, on being distilled in a retort, produced fifteen ounces of a bituminous oil, resembling that extracted from pit-coal; and the residuum yielded, when washed, about half a pound of vitriol.

The method of preparing this earth, in order to render it fit for fertilising land, is as follows: Water is thrown over it, and two or three men knead it with their feet, till they bring it to the consistence of a paste, which is then made into cakes seven or eight inches in diameter: these cakes are laid by to dry, though not to such a degree but that there still remains a little moisture in them, that being necessary to facilitate their burning.

These cakes, thus prepared, are piled up in the form of a pyramid, with sufficient spaces between them for the fire to penetrate; and under this pyramid, which is built upon a kind of hearth, a little straw and brush-wood is laid to set them on fire. Two or three days after, the ashes are spread with a rake that they may cool. Some veins of this earth yield white ashes, but they are not esteemed so good as those of a reddish cast.

From fifty to seventy pounds of these ashes are spread upon each acre of land in April or May; and in about a week's time the blades of corn, or grass, if it be pasture-ground, assume a new verdure, and appear surprisingly strong, even in the coldest soils.

Some of these bituminous earths are better than others. Care must be taken to begin to rake out the ashes of each pyramid as soon as the greater part of it is burnt: for they would lose a great deal of their virtue, if left on the fire till all that is inflammable be consumed: nor would the fire go out in less than a fortnight or three weeks, if they were not scraped away as they are formed.

It may be mentioned, that a greater quantity of ashes of an inferior quality must be used than of those that are strong; and, in general, wet lands require

more than dry soils. The effects of this kind of manure will be manifest for two or three years. It might be dangerous to renew it every year.

Mr. Ellis has observed, that there is a considerable difference between the ashes of lean peat and those produced by the fatter kinds. If barley be sown so late as the beginning of May, lean peat-ashes may be applied over it, or harrowed in with the grain; but ashes burnt from fat black peat, such as is dug at Newbury, are of so hot a nature, that farmers are afraid to lay them on their barley; nor do they dress their wheat with them till the spring is advanced, and then they are sown over it.

These ashes at first, he also observes, fell into disrepute, owing to the injudicious management of people, who imprudently laid on too great quantities of them at a time, by which means the corn was burned. Afterwards they found that six, or at most ten, bushels were sufficient to be sown over an acre of wheat, peas, turnips, clover, rape-seed, or sainfoin, as early as could conveniently be done. But still many are afraid to sow them over barley, lest a dry season should ensue, and burn it up. These peat-ashes, as likewise those of wood or coal, will, says he, help to keep off the slugs from peas and other grains, and conduce very much to their preservation in cold wet seasons. But no danger of over-heating need, he thinks, be feared from the ashes of that peat which grows, as turf, over sandy bottoms, as great quantities do on Leighton-heath in Bedfordshire; for these are as much too lean as the others are too rank.

Pot-Ashes, the refuse or ashes remaining after the burning of different green vegetable matters, from which the alkaline salt called pot-ash has been extracted.

This kind of ashes has been found of great service to most sorts of land; but as they have been in a great measure deprived of their saline property, it is necessary to lay them on much thicker than any other sorts of ashes. Mr. Bradley observes, that a bushel and a half of these may be used in the room of a bushel of fresh ashes; and that they should always be mixed with some other light ingredient, which may be used in any quantity when laid on very stiff land; but, if the land be not over stiff, they may be laid upon it with less mixture. As in places far removed from the means of improvement, a substitute for common manures, that is of easy carriage, and can be had at a moderate expense, must be valuable, pot-ash may be employed; for, from experiments that have been made, it appears that 200lbs. of it are sufficient for an acre of strong land. For lighter soils much less is required, if laid on by itself: on these, however, a compost of this and train or refuse oil, incorporated with mould, will be the best way of employing it. Upon strong clays and deep loams, however, it ought always to be applied by itself. When the expense of carriage is considered, pot-ash will often be found a cheaper manure than lime: and in one respect it is superior; for the union of pot-ash with all the different acids forms a neutral salt, which is in some degree useful in vegetation; whereas, when lime meets with the vitriolic acid, it is almost entirely lost to the purposes of agriculture.

A considerable part, if not the whole, of what is used in manufactures (glass excepted) may be useful as a manure, after the purposes of the different manufactures have been served; particularly in bleaching, the alkali of which will be found improved in consequence of the mucilage or oil which it has imbibed from the cloth.

Soaper's Ashes are a composition of wood-ashes and lime, remaining after the soap-makers have drawn off their lye.

These are in general a very valuable manure; but there is great difference in the quality and effects of them. Those from wood-ashes are the weakest sort, as, wood-ashes being very light and spongy, their salts are soon dissolved, and extracted by the lye; so that there remains but a very slight portion of salt in the ashes. But when the soap-boilers make use of kelp instead of wood-ashes, the kelp, from its being of a harder nature than wood-ashes, is not so easily separated and dissolved by the lye; consequently much more of the salt remains in the ashes. The soap-boilers also make use of another kind of pot-ash, called barilla, which is imported from Spain and other places in large lumps, and which are much harder than common pot-ash; and though they break this sort very small, and sometimes screen or sift it, much more salt remains than when pot-ash is employed; so that the ashes from barilla are for the most part stronger than any other; and if the same quantity of them was laid upon land as is commonly the case with the wood-ashes, they would burn and destroy the crop. Farmers should therefore use soap-boilers' ashes with caution till they know their quality and strength. Wood-ashes and pot-ash are used in various places for making soap; but in and near London, very little of any thing but barilla is employed. The ahses from the barilla are a strong rich manure, and sold at 5s. per cart-load. They are not now, however, so good as they were formerly, the soap-makers having found means to extract more of their salt from them; as they also take the salt from the lye, which was formerly rather superior to the ashes as a manure, and to be had for nothing, being all thrown away as useless.

This excellent manure was first used by the Flemings with great success. Two loads of these ashes are sufficient for an acre of arable land. They should be laid on the ground when the weather is inclined to be wet, in order that the rain may more easily dissolve and wash them in.

As soapers' ashes principally consist of lime, which is used by soap-makers to deprive the alkaline salts of their fixed air, the addition of lime to the ashes is unnecessary. They are generally made into composts with earth and well-fermented dung, in the proportion of two loads of dung to one of earth; the ashes are then added, in the quantity of one load to ten of this mixture, turning and incorporating the whole completely.

The quantity necessary for strong clays or deep loams is ten cart-loads to an acre. If the dung has been well fermented, perhaps the most profitable way of using this compost may be as a top-dressing harrowed in with the grain; taking care, however, that

the caustic quality of the ashes be properly blunted by a sufficient mixture of dung and earth.

These ashes, when beat small, may be made into a rich compost with refuse oil and earth, and used as a top-dressing for young crops. They will destroy slugs and vermin of every description, and are therefore highly valuable on lands where the early wheat is injured by the worm. Laid upon grass-lands in the end of autumn, this manure produces a deep verdure during the winter, and an early vigorous vegetation in the spring; it is therefore particularly calculated for cold wet pastures.

A writer in the *Museum Rusticum* observes, that he has for many years past received great benefit by using soapers'-ashes as a manure, with which he almost constantly dresses his wheat-lands; but never uses it alone, on account of its hot burning quality. His method is, to make a large heap of dung and earth, that is, two loads of earth to one of dung, placed in alternate layers to rot. After this has undergone a strong fermentation, he causes the whole heap to be turned and well mixed, leaving it for some time longer to mellow.

He then procures the soapers' ashes, and mixes them with the compost, in the proportion of one load of ashes to ten of the compost, leaving, for some time, the whole to mellow together; and when wheat-seed time comes, about the latter end of September, he causes about ten cart-loads of this rich compost to be laid in little heaps on each acre of the land he intends to sow with wheat: this manure is immediately spread, and, after sowing his wheat broad-cast, he ploughs it in together with the compost.

The advantages resulting from this practice on stiff soils, he says, are many; particularly if the farmer be careful in preparing his tilth, as he will have a clean crop, which is a matter of no small consequence to him.

He has also tried this manure on lighter lands, and found it to answer extremely well, provided it have lain a considerable time in the compost heap, to mellow, and lessen its natural heat or causticity; but it agrees best by far with clayey soils, and in such is worthy of being recommended as an excellent dressing for wheat-crops.

Turf-Ashes are procured by burning turfs, or the parings of the surface of heathy, moorish, and other lands. Their utility as a manure perhaps chiefly depends upon the proportion of alkaline saline matter which they contain, and which is produced by the burning of the fresh vegetable substances of the turf, and the combination of vital air or oxygen with the clayey part of the soil during the process of combustion.

The parings or turfs intended to be burnt are cut in a dry season, and set up to dry thoroughly, leaning one against another; and, when dry, are piled into small heaps, about a quarter or half a load in each, carried up exactly square to a certain height, and then drawn up gradually in a pyramidal manner, so as to throw off any accidental showers. In a very dry season, even the covering of these piles may be carried home, and stacked or housed indiscriminately with the rest; but, in a wetter season, it is usual to separate and dry those topmost turfs, if the weather allows, and to stack them separately, to be used on the tops of fires, when large, as dampers. A stout labourer, will, in a day, cut two waggon-loads of these turfs. The women and children can set them up to dry, and pile them up.

These ashes, in the moors of Yorkshire, are much used, the principal firing being turfs; are carried out daily, or once in two or three days, to the dunghill; and the farmer takes the opportunity of his first leisure towards the end of the year to carry them out to his meadow-land, on which he lays them thicker or thinner, as he has more or less land which he apprehends to want them, or more or less of them. The first rains wash them in, and the next summer never fails to show their good effects.

It would, however, be probably a much better practice to apply them to the land in early spring, when the weather is rather wet; and not to leave them to be washed away by the heavy rains and land-floods during the winter months. They would also be much more efficacious if kept in sheds, or other suitable places, instead of being carried out to the dung-stead, where the rains must dissolve and carry away their most nutrient properties.

It may be easily imagined, that as these ashes are much finer, or more pulverised, than those of coal, so they insinuate themselves more into the soil; but they are not so lasting in their effects.

In the moors of Yorkshire, the farmers are so sensible of the efficacy of these ashes, that it is become a proverb among them, "The better fire, the richer farmer." In consequence of this principle, they endeavour to procure all the ashes they can from the cottagers who have no land. And hence a happy connection arises; for the poor cottager, finding the article of carriage the chief part of the expense of his fuel, bargains with the farmer to bring him home such a quantity of his turf in consequence of his ashes.

These ashes are said to be a good manure, but much inferior to peat-ashes. Of this a remarkable instance is mentioned: A field, whereof the soil was a poor gravel, and had a crop of the broad and red clover growing upon it, was dressed one side of it with peat-ashes, and the other side with turf-ashes. The farmer laid upon this field all the ashes he had of these two sorts, and the middle of the field had no dressing. The clover in the middle part not dressed was a very poor crop, the plants being short, yellow, and stinted. The side dressed with turf-ashes was much better than the middle, the plants being taller, of a better colour, and promised to be double the crop of the undressed: but that side dressed with peat-ashes produced a crop that appeared to be as much superior to the part dressed with the turf-ashes as this last was superior to the middle that had no dressing at all. The ashes were sown upon the clover by hand; and the improvement made upon the clover was so great, that the cast of the sower's hand was extremely plain next to the middle, and appeared like an indenture: and the vigour of the plants there was so much greater than the undressed plants, that the extent of the peat-ashes might be plainly distinguished almost to an inch. This observation was, however, made in the beginning

of summer, before the clover had arrived to its full growth. See *Paring* and *Burning*.

Wood-Ashes. The ashes produced from wood and most green vegetable products, contain considerable quantities of fixed alkaline salt, blended with the earthy particles; but none, or very little, can be procured by the combustion of dead or decayed vegetable matters. It is from the ashes of the former kinds of vegetable matter, that the alkaline salts, called pot-ash and pearl-ash, are commonly extracted.

It seems also probable, from the observations of the earl of Dundonald, that the effects produced upon land by the application of the ashes of fresh vegetable products, arise from the vegetable alkaline salt which they contain; which, by its action on what he terms the oxygenated or inert mould or earth of the soil, renders it soluble, and more suitable for the nutrition of plants.

As the saline matters contained in these substances are liable to be lixiviated and carried away by moisture, they should always be kept dry and free from water, either by means of sheds or other conveniences. It has been long ago observed, by Mortimer, that one load of dry ashes will go as far as two not kept so. But as rain-water diminishes their salts, so the moistening them with chamber-ley or soap-suds, will add greatly to their strength. Two loads of these ashes will manure an acre of land better than six loads of those that are exposed to the rain, and that are not ordered so; which is the common allowance for an acre, though some lands require more, and some less. That the ashes of any sort of vegetables are very advantageous to land, is what is experienced in most places of England by the improvement that is made by burning of fern, stubble, straw, heath, furze, sedge, bean-stalks, &c.

Mr. Young, in the first volume of his Annals of Agriculture, by an experiment, approves of charcoal-ashes, in preference to powdered charcoal itself. By another experiment, wood-ashes mixed with mud, he says, are superior to ashes alone, and four times better than mud alone, as a manure. In his second volume of the same work, he says, wood-ashes appear to be a most powerful manure. In a neighbourhood abounding with vitriolic acid, they more than neutralise that salt: they furnish, besides, the food of plants. In neutralising it, the fixed vegetable alkali they contain, forms, with the acid, a vitriolated tartar, which is beneficial.

And Mr. Mills says, that the ashes made from straw, furze, fern, &c. are a good manure for most kinds of soils. In the western districts, the farmers sift them over their corn and grass crops; but which should not be done in windy weather, least, from their lightness, considerable loss should be sustained. They are found to succeed best when applied just before the fall of rain.

From the alkaline saline matter contained in ashes, and its known operation on earthy substances, they may most probably be used to great advantage in combination with good mould or earthy materials and dung, in the proportion of one load of ashes to ten of the compost; and they may be applied to tillage-lands as well as those under the grass system, in their simple state; but in the former they would seem to be the most proper when conjoined with other matters, such as have been mentioned above. They may, when employed in the unmixed way, be sown upon the surface, and harrowed-in with the crop for which they are used. But in whatever way they are made use of, they should be spread out as equally as possible on the land. Most grass-lands are improved by their application, but more especially those that are wet, and given to the production of wild-sorrel, rushes, and other coarse plants of the same kind.

When used in the way of compost on tillage-lands, they are generally laid on at the rate of about ten or twelve loads to the acre; but, on pasture or grass-lands, the quantity applied varies very considerably, as from one hundred to one hundred and sixty bushels.

These substances have been found highly useful when sown on the green wheat and clover crops in the spring, and also when harrowed-in with turnip-seed, or sown over the young plants when they first appear, as by this practice the ravages of the fly are said to be greatly lessened. See *Manure*.

ASHLEP, a term sometimes applied to soapers' ashes, or waste; a substance which is much used in some places near large towns on the grass-lands. See *Soapers' Ashes*.

ASPEN-TREE, a species of the poplar, having roundish leaves, with an angular indenture, and smooth surfaces on both sides. The leaves of this tree stand upon long slender foot-stalks, which render them liable to be shaken by the least wind; whence it has been called the trembling poplar, or aspen-tree.

This tree will grow on most kinds of soil, but is cultivated to the greatest advantage on such as are inclined to be moist, without having much stagnant surface water. In such situations, they sometimes grow to a considerable size. They may be raised in the same way, and with equal facility, as the abele and poplar. The wood of the aspen-tree is light, porous, and open; consequently of little value as timber. From its lightness, it might, however, probably be used to advantage for the purpose of common field-gates.

It is proper for being planted on the more moist descriptions of soils, and admits of being cultivated in the same manner as the poplar and other trees of the aquatic kind. See *Poplar*.

ASS, a domestic animal, well known in most parts of Europe; and which might be very useful in many respects, and for different purposes of husbandry, if properly trained and taken care of.

The ass, in his natural temper, is humble, patient, and quiet, and bears correction with firmness. He is extremely hardy, both with regard to the quantity and quality of his food, contenting himself with the most harsh and disagreeable herbs, which other animals will scarcely touch. In the choice of water he is, however, very nice; drinking only of that which is perfectly clear, and at brooks with which he is acquainted.

This animal is very serviceable to many persons who are not able to buy or keep horses; especially where they live near heaths or commons, the barrenest of

which will keep him; being contented with any kind of coarse herbage, such as dry leaves, stalks, thistles, briers, chaff, and any sort of straw. Animals of this sort require very little looking after, and sustain labour, hunger, and thirst, beyond most others. They are seldom or never sick; and endure longer than most other kinds of animals. They may be made use of in husbandry to plough light lands, to carry burdens, to draw in mills, to fetch water, cut chaff, or any other similar purposes. They are also very useful in many cases for their milk, which is excellent; and they might be of much more advantage to the farmer, were they used, as they are in foreign countries, for the purpose of breeding of mules. See *Mule*.

The *diseases of the ass*, as far as they are known, bear a general resemblance to those of the horse. As he is more exposed, however, and left to live in a state more approaching to that which nature intended, he has few diseases. Those few, however, are less attended to than they ought to be; and it is for the veterinary practitioner to extend to this useful and patient animal the benefit of his art, in common with those of other animals. The ass is seldom or never troubled with vermin, probably from the hardness of its skin.

The she-ass, if regard be paid to ~~the breed~~, should be covered between the months of March and June. The best age to breed at is from three year's old to ten, and the young ass should be let suck two years, and not worked till three years old. Those are reckoned the best shape that are well squared, have large eyes, wide nostrils, long necks, broad breasts, high shoulders, a great back, short tail, the hair sleek, and of a blackish colour. She brings forth her foal in about a twelvemonth, but, to preserve a good breed, she should not produce more than one in two years. The best time of covering is from the latter end of May to the beginning of June, nor must the female be hard worked whilst with foal, for fear of casting; but the more the male is worked, in moderation, the better he will thrive.

When the foal is cast, it is proper to let it run a year with the dam, and then wean it by tying up and giving it grass, and sometimes milk; and, when it has forgot the teat, it should be turned out into a pasture; but, if it be in winter, it must then be fed at times, till it be able to shift for itself.

It may when two years old be broken, or if it be of a good growth, it may be let alone still longer, as till three years; and this may be easily done by laying small weights on his back, and increasing them by degrees; then set a boy upon him, and so increase the weights as may be proper, till it is sufficiently heavy. The skins of these animals, when tanned, make the most durable shoes of any sort of leather.

ASTHMA, in *farriery*, an impeded, difficult, or very labouring respiration in an animal; attended with straitness of the chest, and an obstructed circulation in the lungs, threatening suffocation. It is distinguished into the moist and dry kinds. The first, where there is a free discharge of mucus by the lungs and nostrils on coughing; the latter, where the cough, though incessant, is accompanied with little or no discharge of that sort. The former is supposed to proceed from a load of mucous or slimy matter, discharged into the air-vessels of the lungs, and is shown in the horse, by the flanks having a sudden and quick motion; the breathing being short, but without the nostrils being open, as is observed in horses that are feverish or broken-winded. The horse first wheezes some time, and rattles in his throat; then coughs; and the cough is sometimes dry, at others moist. He frequently snorts after coughing, and throws up pieces of tough mucus through the mouth or nose, as well as after drinking, and also at the beginning and ending of his exercise; which discharge often gives him relief. Some are so extremely short-winded, that they cannot easily move until they have been gently exercised for some time in the open air; after which they go through their work tolerably.

This sort of asthma should be carefully distinguished from that pursiveness and thick-windedness which full or foul feeding occasions; also from that which is occasioned by a want of exercise, or on being taken up from winter-grass; in which cases the former is cured by a decrease, and the latter by an increase, of feeding.

Both these states of asthma are usually tedious and obstinate; but when the horse is young, and the disease not of long standing, a recovery is sometimes effected.

Where horses are too full of blood, free bleeding, and repeating the operation as often as the oppression and difficulty of breathing may require, will be useful. Where there is much debility, this should, however, be cautiously employed.

Give the following bolus at night:

Take of calomel, two drachms; honey, a sufficient quantity to make a bolus.

And the next morning the following purging-ball:

Take of aloes, half an ounce to six drachms, gum ammoniacum, assa-fœtida, galbanum, oil of anniseeds, of each two drachms; treacle, as much as is necessary to make them into a ball.

Which remedies may be repeated at due distances of time, and on the days after purging, give the following balls:

Take of cordial ball, half an ounce, powdered squills, Barbadoes tar, (or, in its stead, common balsam of sulphur), of each two drachms: Make them into a ball, for one dose. Or,

Take of gum ammoniacum, assa-fœtida, galbanum, liver of antimony, of each two ounces, fresh squills, enough to form a paste: Make this into balls from one to two ounces each, according to the violence of the disorder.

The latter sort is a cough proceeding from some irritation on the nerves in the membranous part of the lungs and trachea; but there is not any thing discharged by it except a little clear water from the nose, notwithstanding the violence of the cough, and its continuance when once begun, which for some time is almost incessant: the coughing-fits have no regular return; they are more frequent in walking than in other exercise, except when suddenly stopped after hard riding, &c. on which occasion the cough is very troublesome; as well as after drinking; and a change of weather will sometimes make it very teazing for some days; but it is generally worst in the morning. Some-

times, when no particular circumstance occurs to disorder the animal, the cough will seldom be heard for a week or longer; and yet, though so teazing, the horse eats heartily, hunts, and performs his business very well: where tolerably treated, he also keeps a good coat, and maintains most of the usual signs of health. It commonly makes its appearance when about eight years of age. The cough often begins at four or five, and at times is violent; but at eight, and after, the animal labours with his flanks, especially after feeding; and has now an almost constant working of his nostrils, and a motion of his fundament; the disease usually terminating in broken wind, or death.

Bleeding in moderate quantities is here necessary, according to the strength of the horse, and the difficulty of breathing; after which, the calomel bolus may be given at night, repeating it the next night, and on the following morning work them off with the purging ball previously recommended.

While these medicines are operating, it is necessary to keep the horse well clothed and littered, as well as well supplied with scalded bran and warm water.

After the second purge, one of the following balls may be given every morning, letting the animal fast two hours after it, afterwards continuing their use for some time:

Take of antimony, finely levigated, half a pound; gum guaiacum, four ounces; myrrh, gum ammoniacum, of each two ounces; Venice soap, half a pound; honey, enough to make a mass.

Of which about two ounces may be taken for one ball. Or,

Take of gum ammoniacum, fresh squills, Venice soap, of each four ounces; anisated balsam of sulphur, one ounce. Make them into a mass. About two ounces of which may be made into a ball.

Where the disease is obstinate, the bolus with calomel, should be repeated at proper intervals, with or without the purge, taking care that it does not produce salivation.

The same remedies are also proper when a horse wheezes, and continues thick-winded, and with a cough, even when he has recovered his appetite after an obstinate cold. They seldom fail to do good, where the horse is free from a consumption, and not old. Though violent exertion is to be avoided in these complaints, nothing conduces more to the cure of the first sort, than moderate exercise in the open air; which should be proportioned to the horse's strength and constitution.

In respect to a thick wind, as the effect of an asthma, the horses are seldom off their stomachs, but, on the contrary, are for the most part foul-feeders, and naturally strong, except after fresh colds, or violent oppressive attacks. Here, also, gentle exercise is of great consequence, beginning with it in a gradual manner, and having recourse to small feeds frequently repeated; so as never to distend the stomach too much. It is supposed to be the best way with such horses as are thus affected, to abridge their hay, and also to give it in small quantities, as large quantities keep the stomach too much distended, and hinder the action of the lungs. The corn should also be divided; what is usually given at twice being made into three or four portions, and likewise moistened with water; which is an excellent practice in all such cases. They should also be suffered to drink oftener than others, only not to fill their stomach too much; giving them small draughts at a time. See *Broken-wind.*

ASTRINGENT, in *farriery*, a term applied to such remedies as have the power or property of constringing or binding the parts, of course of preventing the effects of looseness, &c.

ATMOSPHERE, the vast body or collection of aërial or elastic materials which surrounds the earth to a very considerable height.

The immense mass of permanently elastic fluid which surrounds the globe we inhabit, consists of a general assemblage of every kind of air which can be formed by the various bodies that compose its surface. Most of these are absorbed by water, many of them are decompesed by combination with each other, and some of them are seldom disengaged in considerable quantities by the processes of nature. Hence it is that the lower atmosphere chiefly consists of vital air mixed with azotic or phlogisticated air, together with moisture and the occasional vapours or exhalations that are set at liberty by the decompositions or changes that are continually taking place in different bodies upon the surface of the earth. The upper atmosphere appears to be composed of a large proportion of hydrogen gas or inflammable air; a fluid of so much less specific gravity than any other, that it naturally ascends to the highest place, where, being occasionally set on fire by electricity, it appears to be the cause of various meteorological phænomena.

Besides these, there is another material that has probably a considerable share in the constitution of the atmosphere, namely, the electrical fluid, as it is found to pervade it very generally, but perhaps somewhat more abundantly in the upper than the lower regions. It seems not improbable but that this fluid may form the bond of connection between the aërial parts of the atmosphere and the humidity or moisture that is suspended or dissolved in it, as it is certain that the fluid of the atmosphere, like other fluids, is capable of holding bodies in solution: and it is found to take up water in considerable quantities, with a diminution of its own specific gravity; from which circumstance, as well as from the consideration that water rises very plentifully in the vaporous state, in vacuo; it is however probable that it suspends vapour, not so much by a real solution as by keeping its particles asunder, and preventing their condensation. Water likewise dissolves or absorbs the air of the atmosphere.

Mere heating or cooling, Mr. Nicholson observes, does not however affect the chemical properties of the atmospherical fluid; but actual combustion, or any process of the same nature, converts it into azotic or phlogisticated air. Upon the power which the air and water of the atmosphere possess, of being changed and converted into each other, probably depends many important phænomena and effects in vegetation.

The fluid which constitutes the atmosphere is so transparent as to be invisible, except by the blue colour it reflects when in very large masses, as is seen in the sky or region above us, or in viewing extensive

landscapes. It is without smell, except that of electricity, which it sometimes very manifestly exhibits; altogether without taste, and impalpable; not condensable by any degree of cold into the dense fluid state, though easily changing its dimensions with its temperature. It has gravity, and is highly elastic.

The general facts on the subject indeed are, that combustible bodies take vital air from the atmosphere, and leave three-fourths of phlogisticated air; and that when these two fluids are again mixed, in the proportion of one-fourth of vital air with three-fourths of azotic or phlogisticated air, they compose a mixture not differing from the atmospherical fluid by any test hitherto discovered.

The respiration of animals produces the same effect on the atmospherical fluid as combustion does, and their constant heat appears to be an effect of the same nature. When an animal is included in a limited quantity of atmospherical air, it dies as soon as the air is vitiated; and no other air will maintain animal life but that which maintains combustion; that is to say, vital air, or a mixture which contains it. Pure vital air maintains the life of animals much longer than atmospherical air. There are many provisions in nature by which the proportion of vital air of the atmosphere, which is continually absorbed in respiration and combustion, is again restored to that fluid. In fact, there appears, as far as an estimate can be formed of the great and general operations of nature, to be at least as great an absorption of the azotic or phlogisticated air, and emission of vital air, as is sufficient to keep the general mass of the atmosphere at the same degree of purity. Thus, in volcanic eruptions, there seems to be as much vital air emitted or extricated by fire from the various minerals, as is sufficient to maintain the combustion, and perhaps even to meliorate the atmosphere. And in the bodies of plants and animals, which appear in a great measure to derive their sustenance and augmentation from the atmosphere and its contents, it is found that a large proportion of azotic or phlogisticated air exists. Most plants emit vital air in the sun-shine; from which it is highly probable that they imbibe and decompose the air of the atmosphere, retaining its noxious part, and emitting the vital part. Lastly, if to this be added the decomposition of water, there will be numerous occasions in which disengaged oxygen or vital air may be supplied; while, by a very rational supposition, its inflammable part may be considered as having entered into the bodies of plants for the formation of oils, sugars, mucilages, &c. from which it may be again extricated and produced.

Besides the great effect and influence which the atmosphere has on vegetation, from the various principles which it contains, and the different substances that are taken up by it and again deposited upon the surface of the earth, it is a principal agent in the changes or mutations that are continually taking place among bodies in nature. And further, by its mechanical action it is capable of contributing to many important purposes in the practice of agriculture, such as the turning of thrashing and other mills, and the cleaning of grain, &c.

ATMOSPHERICAL AIR, that kind of air which constitutes the atmosphere or fluid mass in which animals and vegetables live and grow. It has been found, by chemical investigations, to consist of a mixture of about seventy-two parts of azote or nitrogen gas, and twenty-eight of vital air or oxygen gas. These proportions are, however, found sometimes to vary a little from local and other causes in the fluid which composes the atmosphere. See *Air* and *Atmosphere.*

ATMOSPHERICAL *Electricity*, is the uncombined electrical fluid which floats in the atmosphere; and which, while the air is in a dry non-conducting state, does not reach the earth. It is observed, in an ingenious paper in the twenty-ninth volume of the Annals of Agriculture, that in these circumstances it is constantly positive, and that in steady rain it is the same; but that, in stormy weather, it frequently changes from positive to negative, with singular rapidity; while, at intervals, no electricity at all is observable. See *Electricity.*

ATROPHY, in *farriery*, a morbid wasting and emaciation attended with a great loss of strength in animals.

ATTAINT, among *farriers*, signifies a knock or hurt in a horse's leg, proceeding either from a blow with another horse's foot, or from an over-reach in frosty weather, when rough shod, or having shoes with long calkers.

Farriers distinguish upper attaints given by the toe of the hind-foot upon the sinew of the fore-leg; and lower attaints, or over-reaches, on the pastern joint, which are little bladders like wind galls, coming either by a wrench, a strain, an over-reach, or the like. The usual place is in the heel.

The mode of cure, where the skin is newly removed by a blow or over-reach, is to replace it as soon as possible, and keep it close and free from any extraneous matters, by means of a bandage, or some other convenience; but, in the case of wind-galls, the best method will probably be to have recourse to embrocations of the stimulant kind, and slight blisters.

ATTENUANTS, in *farriery*, are such remedies as lessen the cohesion of the fluid, or other parts of the bodies of animals.

ATTICKI, a term applied to a breed of Arabian horses. See *Horse.*

ATTRACTION, the power or tendency by which the particles of matter combine or unite, and form bodies.

It is observed by Mr. Nicholson, in his Chemical Dictionary, that the instances of attraction which are exhibited by the phænomena around us are exceedingly numerous, and continually present themselves to the attention. The effect of gravity, which causes the weight of bodies, is so universal, that it is scarcely possible to conceive how the universe could subsist without it. Other attractions, such as those of magnetism and electricity, are likewise observable; and every experiment in chemistry tends to show that bodies are composed of various principles or substances, which adhere to each other with various degrees of force, and may be separated by the known methods. It is a question among philosophers, whether all the attractions which obtain between bodies, be referable to one general cause, modified by circumstances, or whether various original and distinct causes act upon

the particles of bodies at one and the same time. The philosophers, at the beginning of the last century, were disposed to consider the several attractions as essentially different, because the laws of their action differ from each other; but the moderns appear disposed to generalise the subject, and to consider all the attractions which exist between bodies, or at least those which are permanent, as depending on one and the same cause, whatever it may be, which regulates at once the motions of the immense bodies which circulate through the celestial spaces, and those minute particles which are transferred from one combination to another in the operations of the chemist and of nature. The earlier philosophers observed, for example, that the attraction of gravitation acts upon bodies with a force which is inversely as the squares of the distances; and from mathematical deduction inferred, that the law of attraction between the particles themselves follows the same ratio: but, when their observations were applied to bodies very near each other, or in contact, an adhesion took place, which is found to be much greater than could be deduced from that law applied to the centres of gravity. Hence they concluded that the cohesive attraction is governed by a much higher ratio, and probably the cubes of the distances. The moderns, on the contrary, have remarked that these deductions are too general, because for the most part drawn from the consideration of spherical bodies, which admit of no contact but such as is indefinitely small, and exert the same powers on each other, which ever side may be obverted. They remark, likewise, that the consequence depending on the sum of the attractions in bodies not spherical, and at minute distances from each other, will not follow the inverted ratio of the square of the distance taken from any point assumed as the centre of gravity, admitting the particles to be governed by that law; but that it will greatly differ, according to the sides of the solid which are presented to each other, and their respective distances; insomuch, that the attractions of certain particles indefinitely near each other, will be indefinitely increased, though the ratio of the powers acting upon the remoter particles may continue nearly the same. This doctrine, which, he says, requires to be more strictly examined, obviously points to a variety of interesting consequences. The polarity of particles, or their disposition to present themselves in their approach to each other in certain aspects, though it has been treated as a chimerical notion by a few writers, is one of the first of these results, and may be not unaptly shown by the experiment of floating bodies upon water, which depress the surface of that fluid, and form a cavity into which they subside, and produce an appearance of attraction by rushing together; in which case their mode of application to each other is considerably governed by their figure, which causes them to turn round, and apply themselves to each other in such a manner as that the sum of the forces that act upon the two bodies may be nearly in equilibrio.

As a proof that gravitation and chemical attraction are two distinct properties, instead of the latter being a modification of the former, it has been noticed that this last is not governed by the masses or specific gravities of the particles. Thus, for example, since spirit of wine dissolves resin, and water does not, it would follow as an inference, upon this system, that the particles of the spirit are denser than those of the water; whereas, the opposite conclusion might have been drawn, if the experiment had been made with gum instead of resin; this substance being dissolved by water, and not by spirit. Nevertheless, it is a good answer to this objection, that, admitting the masses to govern the attractions, yet the modifications of figure may be such as even to have a greater influence in the total effect than the mass itself. Thus it may be conceived, that two cubes of lead may adhere more strongly by their flat surfaces than two cubes of gold, which cannot touch each other but in a point; and the superiority of attraction in the one case over the other may prevail in all the small distances to which chemical effects extend themselves; not to mention that magnitude of particles will as greatly modify the consequences as figure itself. But that the parts of bodies do attract each other is evident from that adhesion which produces solidity, and requires a certain force to overcome it. For the sake of perspicuity, the various effects of attraction have been considered as different kinds of affinity, or powers. That power which physical writers call the attraction of cohesion, is generally called the attraction of aggregation, by chemists. Aggregation is considered as the adhesion of parts of the same kind. The union of bodies in a gross way, is called mixture. Thus, sand and an alkali may be mixed together. But when the very minute parts of a body unite with those of another so intimately as to form a body which has properties different from those of either of them, the union is called combination, or composition. Thus, if sand and an alkali be exposed to a strong heat, the minute parts of the mixture combine and form glass. The earlier chemical writers were very desirous of ascertaining the first principles or elements of bodies; and they distinguished by this name such substances as their art was incapable of rendering more simple. They seem, however, to have overlooked the obvious circumstance, that the limits of art are not the limits of nature. At present we hear little concerning elements. Those substances which we have not hitherto been able to analyse, or which, if decomposed, have hitherto eluded the observation of chemists, are indeed considered as simple substances relative to the present state of our knowledge, but in no other respect; for a variety of experiments give us reason to hope that future inquiries may elucidate their nature and composition. Some writers, calling those simple substances by the name of Primary Principles, have distinguished compounds of these by the name of Secondary Principles, which they suppose to enter again into combinations without decomposition or change. It must be confessed, nevertheless, that no means have yet been devised to show whether any such subordination of principles exists. We may, indeed, discover that a compound body consists of three or more principles; but whether two of these be previously united, so as to form a simple substance with relation to the third, or what in other respects may be their arrangement, we do not know.

From an infinite number of facts in chemistry it is clearly ascertained, that some bodies have a stronger tendency to unite than others; and that the union of any substance with another, will exclude, or separate, a third substance, which might have been previously united with one of them: excepting only in those cases wherein the new compound has a tendency to unite with that third substance, and form a triple compound. This preference of uniting, which a given substance is found to exhibit with regard to other bodies, is, by an easy metaphor, called Elective Attraction, and is subject to a variety of cases, according to the number and the powers of the principles which are respectively presented to each other. The cases which have been most frequently observed by chemists are those called Simple Elective Attractions and Double Elective Attractions. When a simple substance is presented or applied to another substance compounded of two principles, and unites with one of these two principles so as to separate or exclude the other, this effect is said to be produced by simple elective attraction.

And double elective attraction takes place when two bodies, each consisting of two principles, are presented to each other, and mutually change a principle of each; by which means two new bodies, or compounds, are produced of a different nature from the original compounds.

It is observed by Dr. Fordyce, in his elements of Agriculture and Vegetation, that substances combine together:

First, mechanically; by being divided into small particles, and mixed by external force.

Secondly, chemically; by an attraction of the particles of one body to those of another.

And that the particles of bodies do not touch, but adhere by attraction.

Mechanical combination, says he, is of two kinds:

First, mixture; when the particles of one of the bodies attract one another stronger than they do those of the other. In this case, if they be both fluid, the one which is least in quantity is broken down into spheres, as oil is when mixed with water.

Secondly, diffusion; when the particles of the one body attract those of the other as strongly as they do one another. In this case they intermix together equally, as when a solution of blue vitriol mixes uniformly with water, or in the same manner as serum and water.

In mechanical combinations, the properties of the elements remain exactly the same as before the mixture; and the properties of the compound depend on them. When of different specific gravity, they remain mixed from friction, and the attraction of the particles of the one in the largest quantity to one another.

In chemical combination, the substances unite by an attraction, which takes place between themselves, without any external power. A particle of each element unite together, so as to form but one particle considered mechanically. Thus nitrous acid and fixt vegetable alkali form nitre, which is to be considered mechanically as one simple substance.

The properties of the compound do not depend on the properties of the elements.

No mechanical power can separate the substances so combined.

A compound may become an element.

It may also be conceived, says the doctor, that three particles, each of a different species of matter, may unite together, so as to form one compound particle: but there is no given example of this in chemistry; but when a compound contains three elements, two combine, and form a menstruum for the third.

When two substances are to be combined chemically, we call one of them the *menstruum*, the other the *solvend.*

A menstruum will only combine with a certain proportion of the solvend: as, for example, water will only dissolve a certain quantity of salt, and no more.

During the combination, heat or cold is often produced: as, for instance, vitriolic acid in uniting with water, and quick-lime in uniting with water, generate heat. Sal ammoniac and water, air and water, generate cold.

A menstruum will sometimes dissolve several solvends at a time; sometimes only one; as water will dissolve several neutral salts at once; but an acid will only dissolve one metal at a time.

The elements remain combined from the attraction which takes place between them.

Two solids mechanically mixed may be separated:

First, by elutriation; that is, separating two bodies in powder by means of water. If one of the two is of greater specific gravity, or if the particles of the one are finer than those of the other, and both insoluble in water; if they be mixed with water, the heaviest, or that whose particles are largest, will subside first, and the water may be poured off while the other is still swimming in it. Thus clay and sand may be separated in this way: the clay, being finer than the sand, will remain longer suspended, and therefore may be poured off with the water.

Secondly, by dissolving one of them in a menstruum in which the other is insoluble. Thus, an acid dissolves calcareous earth, but not sand; therefore, these two substances may be separated by pouring upon them an acid, which, dissolving the calcareous earth, will leave the sand.

Thirdly, by filtration; if the particles of the one are finer than those of the other, by putting them with water into a filter, whose pores will let the particles of the one pass through along with the water, the other remaining behind. As, for instance, if sand and clay be mixed with water, and poured into a proper filter, the clay will pass through with the water, and leave the sand.

Fourthly, by evaporation, which is the converting a body into vapour and dissipating it. If, therefore, a fixt and volatile substance be mixed, we may separate them by evaporating the volatile one.

Solids are substances whose particles have their attraction of cohesion stronger than their attraction of gravitation.

Fluids have their attraction of gravitation stronger than their attraction of cohesion.

Vapours have their particles repelled to a considerable distance by a power easily overcome by an external pressure.

Heat converts solids into fluids, and fluids into vapour.

Both these changes generate cold.

Evaporation is in proportion to the surface; for external pressure prevents it from taking place so readily, and there is the least pressure on the surface.

A fluid, mechanically mixed with a solid, may be separated:

First, by filtration; that is, making the fluid pass through a filter, whose pores will not let the solid pass through.

Secondly, by subsiding; that is, if they are of different specific gravity, letting them stand together till the solid has fallen to the bottom, or risen to the top.

This separation takes place more or less readily, according to the difference of specific gravity, the size or number of the particles of the solid.

Thirdly, by evaporation; which may be performed when one is more volatile than the other.

Two fluids may be separated from one another in the same manner, *viz.*

First, by filtration; when one is more viscid than the other.

Secondly, by subsiding; when one is of greater specific gravity than the other.

Thirdly, by evaporation; when they are volatile at different degrees of heat.

Two substances chemically combined may be separated:

First, by elective attraction; that is, the application of a third substance, which will unite with one, and separate the other from it.

If calcareous earth, as limestone, be united with an acid, and fixt alkali, as pearl-ash, be applied, the alkali will unite with the acid, and separate the earth.

This can only happen when a menstruum dissolves only one of two solvends at a time; the one uniting with it repels the other, and is said to attract the menstruum stronger.

Two solvends may attract a menstruum equally strongly.

In the following Tables of Elective Attractions, the menstruum is placed at the top of the column; and the substances it will combine with are placed under, in such order, that, if any one of them be combined with the menstruum, any other that stands above it will separate it: as, for example, if silver be combined with an acid, mercury, copper, an alkali, or any other substance standing above it, will separate it.

TABLE OF ELECTIVE ATTRACTIONS.

ACIDS.

Fixt alkalis,
Caustic calcareous earth,
Caustic volatile alkali,
Magnesia,
Zinc,
Iron, lead, tin,*
Bismuth, antimony,
Copper,
Regulus of arsenic, earth of alum,
Mercury,
Silver,
Gold.

ALKALIS AND ABSORBENT EARTHS.

Vitriolic acid,
Nitrous acid,
Acid of amber,
Muriatic acid,
Acetous acid,
Volatile vitriolic acid, tartar, acid of borax,
Gas, or fixed air,
Oils.

METALS.

Muriatic acid,
Vitriolic acid,
Nitrous acid,
Acetous acid,
Gas, or fixed air,
This is not the case in all the metals.

Gas, or fixed air,
Calcareous earth,
Alkalis.

Secondly, by heat. If two substances are combined, one of which is fixed, the other volatile, by heat we may often destroy the attraction between them, and separate the volatile one by converting it into vapour. If the acid of vinegar and copper be combined so as to form verdigrease, if that verdigrease be exposed to a sufficient heat, the attraction will be destroyed, the acid driven off, and the copper left.

The volatile element cannot be converted into vapour until we have applied a sufficient degree of heat to destroy the attraction: although it be volatile, when separate, in a much smaller degree.

If a compound consists of elements which are also compounded, these elements may be decomposed by the heat, and their elements may also unite together, so as to form a substance which was not originally in the compound exposed to the action of the fire; as, for example, if we distil gum arabic with a considerable heat, there will come over an oil which did not exist in the gum.

Thirdly, by cold; for menstruums often dissolve a larger proportion of solvends in heat than in cold: therefore, in this case a menstruum is saturated with a solvend in heat; upon cooling, part of the solvend will be separated; as, if boiling water be saturated with nitre, upon cooling, part of the nitre will separate.

Substances may act upon one another chemically:

First, by solution; when two substances combine together.

Secondly, by precipitation; when a solvend unites with a menstruum, and separates another from it; or when, upon applying two or more compounds, the

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* The comparative attractions of these in the same line are not known: these tables are sufficient for our present subject.

solvends of the one unite with the menstruums of the other.

By precipitation we do not mean the subsiding, but the chemical separation.

Substances separated chemically, require afterwards to be separated mechanically by the means already shown.

Thirdly, by fermentation; that is, a change of the properties of a compound, without any addition to, or separation from, the whole mass, but by a new arrangement of the elements. Or, when a compound consists of elements, which are also compounded, these elements decompose one another, and form new ones, which re-unite, and produce a compound having different properties from the one subjected to the operation.

Substances, in order to act chemically upon one another, must almost always be fluid, or in the state of vapour.

Crystallisation is a disposition in bodies, when they become solid, to form themselves into particular shapes, and to run into certain directions.

This power is capable of overcoming very great resistances. Hence water, in freezing, often breaks the vessel in which it is contained.

Salts, in crystallising, often take up water in their crystals.

All substances are capable of crystallisation, excepting animal and vegetable mucilages.

From experiment it is found, that bodies, upon cooling, contract and retain their shape; therefore that they contract in every direction.—Suppose *a a a b b b*, *pl.* III. *fig.* 1, to represent the section of a sphere, the diameters *a b*, upon the spheres being cooled, become equally shorter in all their parts; but if the particles lying in the direction of these diameters touched, they could not come nearer, and the diameters could not contract; it is evident, therefore, that the particles do not touch.

The particles *o o*, *fig.* 2, of oil, attracting one another stronger than they do the particles *w w*, &c. of the water, form a globule *g g*, surrounded by the particles *w w*, &c. of the water.

The particles *s*, *fig.* 3, of the serum, attracting the particles W of the water as strongly as they do one another, they intermix together equally.

Suppose *n*, *fig.* 4, a sphere of iron immersed in water, it would be surrounded by the particles of water *w w*, &c. In order to sink through the water, it must separate the particles *d d* from one another, and therefore must overcome their attraction; and it must slide along the particles *c b*, and therefore that friction must also be overcome. If, therefore, the difference of specific gravity should not be sufficient to overcome these resistances, the sphere would swim. But the resistance of the attraction of the particles *d d* will be the same nearly in a large and a small sphere; and the total difference of the gravity of a small sphere and an equal bulk of the fluid will be less than the total difference of the gravity of a large sphere and an equal bulk of the fluid; if, therefore, you could diminish the sphere until that difference is less than the attraction of the particles *d d*, it would swim.

As the particles of bodies do not touch, but adhere by attractions and repulsions, they may be considered as acting at the sphere where their attractions are in equilibrio. If there be four particles, as at *p p p p*, *fig.* 5, they may be considered as producing their effects at the spheres *a a a a*.

When two particles *p p*, *fig.* 6, are chemically combined, they may be considered as united at the chemical sphere of action *c*, and now to have acquired one common sphere of mechanical action *m*, their former spheres of mechanical action being lost during their chemical combination.

Thus a particle of volatile alkali, as at *fig.* 7, may unite chemically with a particle of an acid, forming sal ammoniac, in which they have one common sphere of chemical attraction, at which they may unite with copper: and, when so combined, the three particles acquire one sphere of mechanical action.

Substances evaporate more or less readily according to the pressure on their surface; suppose, therefore, that a fluid consists of rows of particles, as at *a b c*, *fig.* 8, the upper row *a* has only the pressure of the atmosphere; but the next row *b* has both the pressure of the atmosphere and the pressure of the upper row; therefore the upper row *a* will evaporate most readily; and as boiling fluids are heated equally, it will require a greater heat to evaporate the row *b* than the row *a*, the whole evaporation will take place from the surface.

AUBIN, in *horsemanship*, a broken kind of gait or pace in a horse, between an amble and a gallop, reputed a defect.

AVENA, a genus of grasses. The oat-grass. Some of the species of which may probably be cultivated to good advantage in suitable situations.

AVENA *Elatior*, tall oat-grass. This grass, though rather coarse from the luxuriance of its growth, makes pretty good hay. Mr. Curtis remarks, that it is more frequently found on the confines of meadows, in hedge-rows and hedges, than in meadows themselves, in which, however, it is sometimes found abundantly. It is early, very productive, and yields a very plentiful aftermath. In excellence, it comes near, he thinks, to the *alopecurus pratensis*, for which it may prove no bad substitute. It is cultivated abroad, as is evident from a communication in the twelfth volume of the Annals of Agriculture, from M. le President de la Tour d'Aigues, in which he observes, that it is the best and most useful of the grasses which meadows can be laid down with. It comes and grows naturally in fresh valleys, spreads much, and grows higher than common grasses; and has this recommendation, that it continues pushing all the summer; and the herbage it produces, not growing hard, is sought after always by the cattle with avidity.

It is easy to be made into hay, and promotes the drying of the other herbage by the intervals which its long blades leave; an important object in those countries where rain is frequent. The hay is of the best quality, agreeable to cattle, and very nourishing; therefore it is made the basis, says he, of all our meadows in the southern provinces of France, where it is the only grass sown. It composes at least the third of the herbage of our feeding grounds.

In fact, to lay down a good pasture, we mix a third

of the seed of the tall oat-grass, a third of trefoil and lucerne, and the remaining third is the seeds from our hay-chambers. The tall oat-grass and lucerne form the basis of the first crop of hay, which is cut the beginning of May. The trefoil adds abundantly to the second cutting in July, and all abound at the third cutting in September. The height of this grass, which is above three feet, is a great advantage, because, without injuring the other productions, the quantity of hay is augmented, and on that account the fodder is much more abundant. This grass does not push during winter, but keeps itself green; and, if hard frosts wither it under foot, it is not the less eaten by the sheep, which we pasture during all that season in these rowings. Its faculty of pushing at all times, except in hard frosts, will be, in these situations, very advantageous to all cattle which are sent early into the meadows. Besides, it is of all grasses that which will suffer the least from the bite of the cattle; always supposing that they are taken out in the earliest spring. My rule, says he, in that respect, is, to take out all cattle by the second of February. One may, with great safety, defer this at least to March, in the northern provinces.

To get the seed of the best quality, it should not, he observes, be gathered from the first hay which is made, but from the second, as in July, it will be riper, and consequently better. Women who go before the mowers, cut off the extremities of the straw which hold the seed. With respect to the dust from the hay-chambers, which we admit among the seeds, it is meant to furnish plentifully the smaller herbage, as nonsuch, medicago lupulina, plantago lanceolata, vernal-grass, anthoxanthum odoratum (which perfumes, as we well know, the hay) and a number of plants and grasses of the second order; all of them very useful, and which, rising but a little height, cannot injure the principal plants, but, giving a full swarth, occasion the grasses to preserve their height entire, and by such means augment the produce of the meadows.

There is a variety of this grass, Mr. Curtis says, with knobby roots, which is a troublesome weed in corn-fields in some parts of this kingdom.

Avena *Fatua*, wild oats; a very troublesome sort of weed in corn-fields.

Avena *Flavescens*, the yellow oat-grass, which is a tolerably sweet grass, but much inferior to many others; it affects dry soils, is rather early, and tolerably productive. Mr. Curtis thinks it bids fair to make good sheep-pasture.

Avena *Pratensis*, the meadow oat-grass, which is a tolerably good pasture-grass, especially for poor, brashy, and stony land, as it thrives where the *poas* will not.

Avena *Pubescens*, the rough oat-grass, which is a tolerably early grass, hardy, productive, and of good verdure; but its foliage is so uncommonly bitter, that it cannot probably be cultivated for the food of cattle.

AVENUE, a walk planted on each side with trees, leading to a house, wood, or other place. These kinds of walks were formerly much more the taste than they are at present: but, when they are to be made, the common elm answers very well for the purpose in all grounds, except such as are very wet and shallow in the soil; and is preferred to most other trees, because it bears cutting, heading, or lopping, in any manner better. The rough Dutch elm is approved by some, because of its quick growth; and it is a tree that will not only bear removing very well, but that is green in spring almost as soon as any plant whatever, and continues so equally long. It makes an incomparable hedge, and is preferable to all other trees for lofty espaliers. The lime is useful on account of its regular growth and fine shade; and the horse-chesnut is proper for such places as are not too much exposed to rough winds. The common chesnut does very well in a good soil, as it rises to a considerable height when planted somewhat close; but, when it stands single, it is rather inclined to spread than grow tall. The beach is a beautiful tree, and naturally grows well with us in its wild state; but it is less to be chosen for avenues than the before-mentioned sorts, because it does not bear transplanting well, being very subject to miscarry. The abele may also be employed for this use, as it is adapted to almost any soil, and is the quickest grower of any forest-tree. It seldom fails in transplanting, and succeeds very well in wet soils, in which the others are apt to fail. The oak is but seldom used for avenues, because of its slow growth.

The old method of planting avenues was by regular rows of trees; a practice which has been adhered to till lately; but now, when they are used, a much more ornamental way of planting them is adopted, which is, by setting the trees in clumps or platoons, making the opening much wider than before, and placing the clumps of trees from one to three hundred feet distant from each other. In these clumps there should always be planted either seven or nine trees: but it must be observed, that this method is only proper to be practised where the avenue is of considerable length, as in short walks such clumps will not appear so sightly as single rows of trees. The avenues made by clumps are the most suitable for large parks. The trees in the clumps in such places should be planted thirty feet asunder; and a trench thrown up round each clump, to prevent the deer from coming to the trees, and barking them.

AVER, a general name for a labouring beast of any kind.

AVERAGE, the pasturage of common fields, and other stubbles, after harvest; also a term improperly made use of by farmers in many places, for the breaking-up of corn-fields.

AVERDUPOIS *Weight*, that kind of weight commonly made use of for weighing most sorts of large and coarse goods, as cheese, butter, salt, hops, flesh, wool, &c. According to it, sixteen drachms make an ounce, sixteen ounces one pound, one hundred and twelve pounds one hundred weight, and twenty hundred weight one ton. It is sometimes written *Avoirdupois*.

AVER-LAND, such lands as were ploughed by the tenants for the use of their lord, were formerly so termed.

AVIARY, a place set apart for the feeding and propagating birds. An aviary should be sufficiently

large, in order to allow the birds a considerable freedom of flight; and turfed at the bottom, to avoid the appearance of foulness on the floor.

AUGHTENPART *Lands*, an ancient kind of tenure, or condition of land, in which it lies, in a sort of run-ridge manner. Some remains of it are still met with in the northern parts of Scotland.

AUGRE, an instrument much used by carpenters, wheelwrights, and others, for boring round holes. It consists of a wooden handle and an iron blade, terminated by a steel bit, as represented in *pl.* II. *figs.* 5 and 6.

Boring Augre, an implement for boring into the soil with.

An augre of the above kind, when made of a large size, and with different pieces to fix on to each other, may be very usefully applied to try the nature of the under soil, and layers of earth, in order to know what may be expected from them in regard to the vegetation of plants, and also for the purpose of discovering springs and drawing off water from lands. In order to accomplish the first purpose, three augres will be necessary; the first of them about three feet long, the second six, and the third ten. Their diameters should be near an inch, and their bits large, and capable of bringing up part of the soil they pierce. An iron handle should be fixed cross-ways to wring it into the earth, from whence the instrument must be drawn up as often as it has pierced a new depth of about six inches, in order to cleanse the bit, and examine the soil.

The borer, an instrument invented by the Marquis de Tourbilli, is also well adapted to this operation. See *Borer*.

Draining Augre, an instrument employed for the purposes of boring into the bottoms of drains or other places, in order to discover and tap or let off water. It is nearly similar to that made use of in searching for coal or other subterraneous minerals. See *Borer*.

The augre, shell, or wimble, as it is variously called, for excavating the earth or strata through which it passes, is generally from two and a half to three and a half inches in diameter; the hollow part of it one foot four inches in length, and constructed nearly in the shape of the wimble used by carpenters, only the sides of the shell come closer to one another. The rods are made in separate pieces of four feet long each, that screw into one another to any assignable length, one after another, as the depth of the hole requires. The size above the augre is about an inch square, unless at the joints, where, for the sake of strength, they are a quarter of an inch more.

There is also a chisel and punch, adapted for screwing on, in going through hard gravel, or other metallic substances, to accelerate the passage of the augre, which could not otherwise perforate such hard bodies. The punch is often used, when the augre is not applied, to prick or open the sand or gravel, and give a more easy issue to the water. The chisel is an inch and a half or two inches broad at the point, and made very sharp for cutting stone; and the punch an inch square, like the other part of the rods, with the point sharpened also. In *pl.* IV. *fig.* 1, is the rod; *fig.* 2, the chisel and punch; *fig.* 3, the augre.

There is a shifting handle of wood, that is fastened with two iron wedges affixed to it, for the purpose of turning round the rods in boring; and also two iron keys, for screwing and unscrewing the rods, and for assisting the handle when the soil is very stiff, and more than two men required to turn it. *Fig.* 4, shews the wooden handle; *fig.* 5, the key; *fig.* 6, the iron handle.

It is remarked by Mr. Johnstone, in his account of Mr. Elkington's mode of draining, that to judge when to make use of the borer is a difficult part of the business of draining. Some, says he, who have not seen it made use of in draining, have been led into a mistaken notion, both as to the manner of using it, and purpose for which it is applied. They think, that if by boring indiscriminately through the ground to be drained, water is found near enough the surface to be reached by the depth of the drain, the proper direction for it is along these holes where water has been found; and thus make it the first implement that is used. The contrary is the case, and the augre is never used till after the drain is cut; and then for the purpose of perforating any retentive or impervious stratum, lying between the bottom of the drain and the reservoir or strata containing the spring. Thus does it greatly lessen the trouble and expense that would otherwise be requisite in cutting the trench to that depth to which, in many instances, the level of the outlet will not admit. The manner of using it is simply thus: in working it, two, or rather three men are necessary. Two stand above, on each side of the drain, who turn it round by means of the wooden handles, and when the augre is full they draw it out; and the man in the bottom of the trench clears out the earth, assists in pulling it out, and directing it into the hole, and who can also assist in turning with the iron handle or key, when the depth and length of rods require additional force to perform the operation. The workmen should be cautious, in boring, not to go deeper at a time, without drawing, than the exact length of the shell, otherwise the earth, clay, or sand, through which it is boring, after the shell is full, makes it very difficut to pull out. For this purpose the exact length of the shell should be regularly marked on the rods, from the bottom upwards. Two flat boards, with a hole cut into the side of one of them, and laid alongside of one another over the drain, in the time of boring, are very useful for directing the rods in going down perpendicularly, for keeping them steady in boring, and for the men standing on when performing the operation, as may be seen at *fig.* 7, in the annexed plate.

Horizontal Augre, another instrument of this kind, employed in particular cases. It was lately invented, Mr. Johnstone says, by Mr. Haford, of Hathern, in Leicestershire, and is not yet come into general use. The advantages of it are, in many cases, considerable, by lessening the expense of otherwise cutting, and performing the work in a much shorter time. Where a drain or water-course has to pass under a bank, road, hedge, wall, rivulet of water, or for drying marl-pits, &c. it may, he observes, be used to advantage in excavating a sufficient passage for the water, without opening a trench. In laying

leaden pipes for the conveyance of water, it is also useful in making a hole in which the pipe may be laid without opening a cut on purpose. For tapping springs, or finding water at the bottom of a hill, either for the supply of a house, or for draining the ground, it may likewise be used with success; as the water of the spring, when hit on, will flow more easily, and in greater abundance through a horizontal or level, than through a perpendicular outlet. It is seen at *fig.* 8. *pl.* IV. where *aa* is a frame grooved within eight feet ten inches; *bb*, ends of the frame, two feet ten inches, through which the screw and augre pass; *cc*, bottom of the carriage, to which the uprights are fixed; *dddd*, upright standards, four feet high; *e*, spindle, two feet ten inches long; *f*, upper cog, with ten teeth; *g*, lower cog, with twenty-four teeth; *h*, main wheel, with thirty-two ditto; *i*, screw, six feet three inches; *k*, augre, six feet long and three and a half inches in diameter; *l*, winch and roller for reversing the rods; *m*, two side wheels, with twenty-four cogs each, upon which the two handles are fixed; *n*, joint for lengthening the rods.

The manner of using it is this: suppose a lake or pond of water, surrounded with high banks, to be emptied, if the ground declines lower on the opposite side, find the level of the bank where the perforation is to be made. There smooth the surface of the ground so as to place the frame nearly level with the augre, pointing a little upwards. It requires two men to turn the handles at top, in order to work it, which may be better understood by examining the plate. When the augre or shell is full, the rods are drawn back, by reversing the lower handle; and other rods added at the joint when the distance requires them. In boring through a bank of the hardest clay, two men will work through from thirty to forty feet in a day, provided there is no interruption from hard stones, which will require the chisel to be fixed on in place of the shell, and longer time to work through. If the length to be bored through is considerable, or longer than the whole length of the rods, a pit must be sunk upon the line, down to the hole, for placing the frame when removed, and the operation carried on as before.

AUGUST, the eighth month of the year. In this month the farmer's expenses begin to return into his pocket.

As this is the period of harvest, it is obviously to the farmer the most important of any throughout the year, as it is now he expects to reap the reward of his anxious and watchful daily labours: but the assurance of this, the author of the New Farmer's Calendar says, will materially depend upon a system of management both spirited and correct, the consequence of a plan previously adjusted, in which the number of hands are fairly apportioned to the quantity of labour; and those well and reasonably satisfied, that the extraordinary exertions which circumstances frequently render necessary, may be performed with cheerfulness and celerity. At this important season, trifling savings should be disregarded, as it is much more safe to be over than under done, in point of strength, whether of men or cattle; for the harvest-work must not only be minutely attended to, but at the same time all the other necessary branches of labour should be performed, and not be neglected or postponed under the absurd pretence of the superior importance of harvest-labour. It should be recollected, that hoeing, fallowing, folding, sowing, stock-feeding, and many other practices, are of vast consequence, and indeed the means of a successful harvest: of course they should at no rate be slighted. These may be very much forwarded by a judicious use of the leisure intervals which now present themselves.

The method of engaging labourers for harvest-work is nearly the same in all the districts of the kingdom: part, or all, of the constant workmen upon the farm receive harvest-pay for a certain number of weeks; and the extra hands agree for their work by the acre, according to the condition of the crop, heavy or light, lodged or upright. It is the farmer's, or his bailiff's, duty, to take care that these acre-men do not make too much speed, by cutting or binding in unseasonable weather; and that they make the sheaves of proper size, with regard to the quantity of weeds to be withered, and the state of the corn. It is, he thinks, an excellent method to agree with mowers and reapers, both at hay-time and harvest, to finish by cutting down all the weeds in the hedge-rows and other places.

Mr. Young, however, remarks in his Calendar, that "a common way, in some parts, is to agree with the men for all, by the acre; to reap or mow, turn, shock, make, cart, stack or barn, drive, &c.&c. to do all the business of the harvest, in short, at so much per acre: and this is, he thinks, a very good way; but it requires a man to be almost as watchful as for day-work: for a very strict eye should be had to the *manner* in which every thing is done; that the men do not cut the corn at improper times; that they take proper care to turn it after rain, and to get it perfectly dry into the barn. A pretty sharp attention will be requisite to all these points, and many others. On the other hand, when the work is done by the day, month, or week, it requires, he says, constant attention, early and late, to see that the men work their hours; and that upon *carrying*, in dubious weather, they work as long as they can see, unless the dews are heavy; for it is a maxim in most countries, that men are not to talk of *hours* in harvest, but to do whatever they are ordered." And that, "in many counties, it is the custom to board the harvest-men, and in some they are fed at an extravagant rate: he would by all means advise the economical farmer to vary this matter, if possible, unless the men really work at a great rate, and stick to it early and late; but, if the custom is rooted so deeply, that they will not give it up, then it is an object of attention to make the expense as moderate as possible, which must be by a previous plan of fatting a beast or two, and a few sheep for the purpose; and also by providing whatever else may be consumed." It is further stated, that "for many years, that is to say, till the scarcities, he put out his harvests to the men at fifteen acres per man, and 4*s.* per acre for spring corn, and 5*s.* per acre for wheat, beans, and peas; three bushels of malt per man instead of beer, and from 5*s.* to 7*s.* 6*d.* per man in lieu of *earnest*, dinner, gloves, and *hawky*, or harvest-home supper, at which rates the whole harvest came to about 3*l.* 10*s.* per man: it rose to 5*l.* 5*s.* and then even to 6*l.* and 7*l.* 7*s.*

a man; so that at present, in some parts of Suffolk, the expense is, he says, not less than 10*s*. 6*d*. an acre, every branch of labour included. And this is much lower than it is in some counties. In the fens of Lincoln and Cambridge, where cottage-building has by no means kept pace with improvements, he has known 10*s*. 6*d*. a day, and ten pints and a half of ale, given; and 27*s*. per acre for reaping oats. There, the strangers who go to assist in the harvest will let themselves only for the day; they are found at four o'clock in the morning on certain bridges, and the bargain is made for the day, according to weather and competition. As the price of labour, in common with other expenses of farming, must, he conceives, eventually regulate the rent, landlords are blind to their interest in not building cottages: unite this with the baneful custom of not giving leases, which prevent farmers building, and the folly must, he thinks, be seen in its true colours. In order to bring the harvest-business together, he has treated this matter under this month, but the young farmer is to remember that the harvest-bargain is usually made long before this time; Whitsun-Tuesday is, he says, the common day for it in Suffolk."—*See Harvesting of Grain.*

In the cutting of wheat, a medium state of ripeness is probably the best; as, when it is reaped too green, it can never be made a fine sample by remaining in the sheaf; and the grains are liable to become pale and shrivelled: and when left till it is fully ripe, it is apt to shed on the slightest motion, by which considerable loss is sustained. When in this state, it is a good practice to cut it in the morning, while the dew is upon it.

In carrying grain, the number of teams must be proportioned to the quantity of labour that is to be performed; but, on pretty large farms, three waggons and five horses to a field make all needful dispatch, as they will keep the proper number of hands busy, both in the barn and the field. As to stacking abroad or housing, it is a matter nearly indifferent, of course referable entirely to local convenience. The only inconveniences of stacking are, danger of storms and difficulty of removal to the floor in wet weather; these are, however, easily obviated.

All kinds of grain should remain in the field until perfectly dry and cured: this is absolutely necessary to its preservation. Barley should, in general, lay abroad longer than other sorts of grain: the usual time is from three days to a week. A heavy shower or two does not injure it; on the contrary, it imbibes the moisture, and swells much to the farmer's profit; and the colour may be preserved. In case, however, of constant soaking rains, the value both of the sample and the fodder will be much diminished. Some farmers, notwithstanding, cut and carry barley with success. It is customary in most places to rake after all sorts of crops, wheat excepted: this is performed most expeditiously by the horse or the dew-rake, drawn by a man; but this method is objected to by some, on the grounds that, in a driving soil, they rake as much dirt as corn; and, in a stiff one, they jump over the clods and miss half the corn. For this business nothing is, perhaps, comparable to hand-labour, as, when care is taken to rake clean after the load, the remainder is easily performed.

Oats are extremely apt to shed in cutting and moving, of course require great care in these operations, and also in the preserving of their delicate white colour in making. These are often the first new corn wanted upon a farm; they should, therefore, be placed in a convenient situation to be come at. In case of a want of old oats, the new should be dried in an oven or kiln, for the use of the horses on the farm.

Peas are mostly hacked, or cut with the reaping-hook: when carried, they are safest in the barn; when put in ricks, they should be thatched immediately, and very securely.

In harvesting seeds, much depends on good weather. In order to *get the seed while the sun shines*, a great number of hands are necessary. Seeds are commonly threshed abroad. The most careful reapers should also be selected for these crops, as without much care great losses may occur. As this work can only go forward in fine weather, the threshers must be constantly attended with supplies; and at the same time the seed moved homewards, until all be finished. There are various contrivances for moving the crop to and from the threshing-floor: some use little covered one-horse waggons, constructed with poles and cloths, fixed upon truck-wheels. The number of men, women, and children, should at first be properly apportioned to these various services. Grass-seeds being harvested, of course, after threshing, the grass is made into hay; which, although of an inferior kind, makes good fodder for store-cattle, in many cases.

In the agreements with harvest-labourers, it should always be understood, and of course particularly mentioned, that, in that season, there are no set hours, set days, or holidays, but that, night and day, they are at the call of the master; and that they are not hired for this or that particular service, but that every thing which may become necessary to be done about the farm, whether of harvest or other work, during the intervals of bad weather, is their proper business. The reward of this extra labour is included in the extraordinary pay of harvest, and in the good cheer made by the farmer.

Upon many farms, a considerable number of harvest-men are often boarded in the house; and farmers, in general, are not apt to be niggardly at this season: when, however, there is an excess, although it may temporarily gratify, it is a real prejudice to the labourer.

Where small-beer is allowed, it should be of sufficient substance, pretty well hopped, and brewed from soft water; as, under these circumstances, it is a great refreshment and support to labour, more so than even strong liquor. In order to contract the harvest expenses within the narrowest possible compass, every supply of provision which can, ought, as has been already stated, to be derived from the farm: thus a bullock or two, or a few sheep, may be fatted for this occasion with vast advantage.

The teams which have been toiling through the summer, will require, during the exertions of harvest-

time, the best dry meat and stable-attendance, in order to render them adequate to the labour.

Hoeing, and the drill-culture, must not be neglected this month on the pretence of more pressing business; for it would be to throw away a great part both of the past expense and future advantage. Turnips will require another hoeing this month; and the harvest-field may supply the necessary hands, either male or female. Potatoes and carrots may be hand-weeded, and perhaps require a slight farewell hoeing, that, at taking up the crops, the land may turn up perfectly clean and in fine order. Cabbages and lucerne will also require hoeing, weeding, and earthing; and, in general, all rows or drills should receive a stirring with the plough or cultivator, to loosen and pulverise the soil, and supply the roots of the plants with fresh and renovated earth; probably two of the most important advantages of the row-culture. In cleaning the potatoe crops, in some cases, the skim may be used with care.

Where lattermath or rouen can be got ready to cut so early as this month, it is a vast advantage, on account of the greater warmth and certainty of the weather to what may be expected later in the season; and such advantage may almost always be secured by high manuring, without which, indeed, no second crops of grass can be expected on many soils. On that condition, a second cutting of sainfoin may also always be had, without the smallest injury to the grass or future crops. Upon most farms, green food is plentiful in autumn, after clearing the corn-fields; and, on all, hay in the winter-season is particularly valuable. It is at this time proper to determine upon the quantity of *fog*, or old grass, which may be wanted for the use of the stock in the spring, and to shut it up accordingly.

Fallows ought, in general, by this period, to be in a state of clean and fine tilth; but some few remaining weeds, or a baked surface, may require another stirring, which, on no pretence ought to be neglected. Previously to this, they should receive the benefit of the fold, when that practice can be adopted.

As early sowing for the most part succeeds best when a part of the wheat can be got in upon the fallows at this time, it is an advantageous point gained. Rye and tares for spring-feed may now also be put into the ground. Sowing for early cabbages may likewise commence. The seed-bed being made as fine as possible, and manured to the utmost with rich rotten dung, the seed should be sown thin, that the plants may have room to come up strong, and with sufficient vigour.

Besides cabbage-seed being sown for plants to be transplanted in April, some should be put in in drills where the plants are to remain. Also sow rape for crops to be reaped.

Compost or soil may be laid on such lands as are intended either for barley or wheat, and the farm-yards be laid with different sorts of earthy materials.

Wood, or other fuel, should be carried home at this period, before winter approaches, and renders the roads deep and heavy.

Good seed of different kinds should be selected and preserved against seed-time.

Different sorts of live-stock may be put up to fatten, and the practice of folding be carried on with regularity. The hogs may now also have lettuces. Hemp and flax should be pulled. Stock-lambs should be set, and those not wanted sold off. This is also the proper season for sowing grass-seeds, especially on the strong, heavy, and moist soils, for laying them down to grass. Poor mossy lay lands may likewise now be scarified, harrowed, and have seeds sown over them; which will greatly improve them. Rouen may likewise be wholly shut up for winter and spring use.

About the end of the month, begin to mow after-grass, and also clover, sainfoin, and other artificial grasses. Lambs may likewise be castrated or gelded, and the second return of fat sheep and cattle made.

AWNS, the needle-like bristles which form the beards of wheat or barley. The word is, in some parts of England, pronounced *ails* and *iles*.

AX, an edge-tool with a long handle, for the purpose of hewing and cutting wood, &c.

AXIS, the strong piece of wood or iron which supports the weight of waggons, carts, carriages, &c. and round the extremities of which the wheels turn. It is frequently called axle-tree. See *Cart* and *Waggon*.

AZOTE, or AZOTIC GAS, a matter which cannot be exhibited in a separate state; its properties are only distinguishable in its various states of combination. It is termed azôte in modern chemistry, on account of its having the opposite quality to that principle which supports life. Azotic gas exists in the state combined with heat in the atmosphere; and, mixed with a certain portion of oxygen gas, it forms the essential composition of atmospheric air. It exists in the atmosphere, apparently for the purpose of modifying the effect of that powerful agent, the oxygen, in the process of respiration of animals and plants; as oxygen gas alone may become hurtful in many respects. It serves also for modifying the rapid effect of oxygen during combustion and other operations, and thus also enables us to modify the heat extricated from bodies during their decomposition and combination. It is most likely, that in that state in which it exist in the atmosphere, it enters into combination with other bodies, and produces new compounds. It constitutes, according to the discovery of Cavendish, Lavoisier, and Priestley, the basis of nitre and nitrous acid, and also of nitrous air. These three substances differ from one another only in the proportion of the oxygen to the azotic principle, of which the latter, the nitrous air, contains the smallest: but this has a strong tendency for saturating itself with oxygen whenever it can receive it from a surrounding body, as the atmosphere; and hence it has been found useful for ascertaining the quantity of oxygen gas contained in certain mixtures of gasses, as in the atmospheric air, &c.

It is always mixed with a small quantity of vital air and carbonic acid, which must be removed in order to have the azotic or nitrogen gas in a state of purity.

It has been found that this mephitis can be procured by treating muscular flesh, or the well-washed fibrous part of the blood, with nitric acid in a proper

apparatus. But care must be taken that these animal matters be fresh; for, if they have begun to be changed by the putrid fermentation, they afford carbonic acid mixed with hydrogen gas. This gas has been found to be improper for respiration and combustion; but plants can live and vegetate freely in it; and it mixes with the other airs, without combining with them; but is lighter than the atmospheric air. The barometer standing at 30.46, and Fahrenheit's thermometer at 60; the weight of nitrogene gas has been determined to be to that of common air as nine hundred and eighty-five to one thousand. When mixed with vital air, in the proportion of 72 to 28, it constitutes what is termed the atmosphere. The other principles which analysis has demonstrated in the atmosphere, are only accidental, and by no means essential to it. The explanation of a few of its properties, will afford more certain ideas of its nature. From its being somewhat lighter than common air, it of course occupies the upper part of rooms in which the air has been altered by combustion or respiration. But though so noxious to animals in the state of elastic fluidity, the azotic principle, or its base, is one of the component principles of animal bodies; from which it may be extracted in great abundance. It is likewise one of the constituent materials of ammoniac or volatile alkali, and of the nitric acid. It appears to be absorbed by vegetables, and probably also by animals; and it is highly probable that it enters into the composition of all alkaline bodies, and may be considered as a genuine *alkaligenous* principle, in opposition to the base of vital air, to which the name of the oxigenous principle has been given.

The azotic principle, combined with a due portion of oxygen, forms, as already observed, nitric acid; and it has a strong disposition to combine with many other bodies, as with alkaline salts, in combination with which it is found in certain plants and earths. It has also, when set at liberty, an attraction for hydrogen; with which, when combined in a due proportion, it forms, as just noticed, ammonia, or the volatile alkali, a substance likewise found in some plants, united with acids.

Azotic gas, or azote combined with heat, may be obtained free from oxygen, with which it is mixed in the atmosphere, by exposing to atmospheric air a body which has a superior electrive attraction for the oxygen, and which will therefore absorb the oxygen; as, for instance, phosphorus or heated sulphur. It is set at liberty, when mixed with carbonic acid or fixable air, by the process of combustion of charcoal, or more difficulty by respiration. When combined with heat, it cannot support life nor combustion; and therefore its presence, when not accompanied by oxygen, must, it is supposed, be more or less hurtful to animals and vegetables in the process of respiration, &c. yet its other qualities soon prevent the bad effect which might arise from its presence: as, for example, its being lighter than atmospheric air causes it to rise in it, or to leave that part of the atmosphere where it has been deprived of the oxygen either by the process of respiration or combustion, and consequently it is carried off from the place where it might have been hurtful to organised bodies, and have interrupted the process of combustion.

Plants, in general, according to the observations of Humboldt and Scopoli, soon die when exposed in it; but there are some which continue to grow in it, such as lichens, and some others.

B.

BACK, the spine, or that part of animals upon which the saddle is placed. The back of a horse should be straight, in order that it may be strong, and capable of supporting great weights; as, when it is hollow, or what is termed *saddle-backed*, the animal is generally weak, and liable to stumble.

BACK *Galled*, a local disease frequently happening to horses in travelling, especially when young, mostly from want of the saddle being properly fitted. See *Back Sore*.

BACK *Sore*, a complaint which is very common to young horses when they begin to travel. In order to prevent it, their backs should be cooled every time they are baited, and now and then washed with warm water, and wiped dry with a linen cloth: and the saddle should also be scraped, so that no hardness or inequalities remain from the sweat, that, together with dust, sticks round the seat of the pannel. When a degree of inflammation and swelling has taken place, the best mode of cure is probably to wash the part well with a saturnine lotion, salt and water, or warm vinegar; and at the same time to avoid all pressure on the part. Where the pressure is removed before the inflammation is too far advanced, there will be a greater chance of preventing a *sitfast* or warble. But where the skin is broken into holes from the last, embrocations made with equal quantities of spirits of wine and compound tincture of myrrh, with a small proportion of spirits of turpentine, may be used with advantage.

BACKING *a Colt*, the operation of breaking to the saddle, or bringing him to endure a rider. In order to back a colt, the usual method is to trot him a while, to tire him; then, having a person to stay his head and govern the chaffing rein, to take his back, not suddenly, but by degrees; first making several heavings and half-risings. When he bears these patiently, you may mount in earnest, and settle in your place, taking care to cherish him, &c.

BACK-RAKING, an operation so called by farriers. It consists in anointing the hand very well with any sort of oil or lard, and introducing it gently into the horse's fundament, fetching out by little and little, the hardened excrements, when he has got a cholic, and there is reason to suspect that it proceeds from hardened fæces in the rectum. In this operation the farrier should introduce his hand and arm as far up as he well can. The properest person to do this is one who has a hand and arm of the smallest size.

BACK-SINEW, in the anatomy of the horse, is that strong tendon or sinew extending on the hinder part of the shank, from the knee to the heel, into which it is inserted.

BACK-SINEW *Strain*, an affection of the part, produced from different causes. The back sinews of horses are so very subject to be hurt or strained, that it is considered as one of the most common and usual accidents that happens to them. It generally proceeds from hard riding upon dry grounds, or where the roads are stony and hard, and sometimes where they are poachy.

It is easily perceived by the swelling of the sinew, which sometimes extends from the knee down to the heel; in which situation a horse does not care to set his foot to the ground; but for the most part, in standing, puts it before the other.

The usual way of curing these sprains is by means of cold charges, frequently renewed: some also use curriers' shavings, bound round the knee with a bandage: but there is nothing either so ready or efficacious as vinegar or verjuice mixed with bole, which should often in the day be soaked well into the sinew warm; and where any thing of lameness or swelling remains after this, when the heat and inflammation are gone off, a mild blister, that has nothing corrosive in it besides the causticity of the flies, will generally effectuate a cure, and bring the sinew fine again. A volatile liniment or embrocation may also, in some cases of this kind, be employed with considerable advantage.

When hot and relaxing oils are used to the back-sinew, which many practitioners are fond of, because they sometimes succeed in horses that have their sinews strong and rigid, they are apt to engender windgalls of a bad kind, or make the veins on each side the sinew full and gorged; and horses have been known to be lame for two or three years together with these varixes in the veins. Blistering in this case has very little or no effect, firing the vein till the blood comes being only sufficient to remove that weakness. After the firing, the whole leg from the knee down to the heel, and all the hollow places on both sides, must be charged with a good strengthening plaster, which will perfect a cure, especially if the horse be turned to grass for a month or five weeks; or, in the winter, if he runs a little while in a smooth yard, where he has good dry litter.

Where a horse, that is perfectly free in his limbs, is suddenly attacked with lameness, attended with swelling on the part, after hard running, a leap, a fall, or a slip, without any blow, contusion, or wound in the tendon, the existence of a strain in the ligaments, and sheaths of the tendons may be suspected. But, as

in this case the fleshy fibres must participate in the effect of the extension, it should not be neglected to feel the extensor muscle of the foot, which is situated at the hinder part of the arm, to discover whether the animal experiences pain in that part or not. When inflammation and swelling are present, emollient substances should be first employed.

Take of marsh-mallows, pellitory of the wall, each one handful and an half: boil them, in common water for three quarters of an hour, and then shred them fine for a poultice, which must be applied to the leg, from the knee down to the foot, moistening it frequently with the decoction.

Or, in the place of this,

Take of crumb of bread, linseed meal, equal quantities: form them into a poultice with the decoction. Or warm water may be used by way of bath, or fomentation.

Where the disease is of long standing, small hard swellings often appear in the sheaths of the tendons, to the number of two, or even three, which are called *gang-lions*; whose situation near the tendons is sufficient to make the horse walk lame. In these cases Mr. St. Bel recommends the operation of FIRING, which, in his opinion, often produces good effects, when made use of before the humour becomes concreted, and the tumor insensible and hard. Under the latter circumstance, the effect of firing goes no further, he says, than to extract what little fluid may remain in the affected part, by the inflammation and suppuration it creates; increasing the hardness, and for ever preventing its discussion. Experience has shewn, that the diseased part, after this operation, is injured by too much rest: exercise should, therefore, be given to promote a cure.

On the first appearance of this sort of strain, some advise the use of strong camphorated spirits of wine, rubbing it well on the parts affected, and afterwards a moderately tight bandage, dipped in cold water, to be applied.

BACKSTONE, a provincial term, applied in Yorkshire to a flat stone put over the fire to bake cakes upon.

BACON, the flesh of the hog, after it has been salted and dried, either in the smoke of the chimney or without being smoked. In the former case it is termed smoked bacon, and that method of preparing it is peculiar to certain districts. Such hogs as have been kept till they are full grown, and of a large size, are for the most part converted to the purpose of bacon.

The following is the method of making bacon in Hampshire and Somersetshire:

The season for killing hogs for bacon, is between October and March.

When large hogs are killed for bacon, they first lay the sides in the salting-troughs, and sprinkle them pretty heavily with bay-salt; then leave them twenty-four hours, in order for the blood and some of the over-abounding juices to drain away.

After this they take them out, wipe them very dry, and throw away the draining. They then take some fresh bay-salt, and, heating it well in a large iron frying-pan, rub the meat very well with it; repeating this work every day for four days, turning the sides every other day.

If the hog be very large, they keep the sides in brine, turning them occasionally, for three weeks; after which they take them out, and let them be thoroughly well dried in the usual manner; for, if they are not fully dried, they neither keep so well, or eat so fine.

Mr. Bradley, in his Treatise on Husbandry and Gardening, observes, that the method used to cure bacon in and about Hamburgh and Westphalia is after this manner: Families that kill one, two, or three hogs a-year, have a closet in the garret joining to their chimney, made very tight and close to contain smoke, in which they hang their bacon to dry, out of the reach of the heat of the fire, that it may be gradually dried by the smoke only, and not by heat. The smoke is conveyed into the closet by a hole in the chimney near the floor, and a place made for an iron stopper to be thrust into the funnel of the chimney, about one foot above the hole, to stop the smoke from ascending up the chimney, and force it through the hole into the closet. The smoke is carried off again by another hole in the funnel of the chimney above the said stopper, almost at the ceiling, where it vents itself. The upper hole must not be too big, because the closet must be always full of smoke, and that from wood fires; for coal or turf, or peat-smoke, he apprehends, will not do so well.

The manner of salting is no other than as we salt meat in common; sometimes they use our Newcastle salt, or St. Abb's, or Lisbon salt. In those parts they do not salt their bacon or beef so much as we do in England, because the smoke helps to cure as well as the salt.

In Kent, and some other counties, when hogs are intended for bacon, the hairs or bristles are singed off by means of a straw fire: the flitches are afterwards cut out, and rubbed well with a mixture of common salt and salt-petre, and then laid in a trough, where they continue three weeks or a month, according to their sizes, keeping them frequently turned; they are then taken out of the trough, and dried by a gentle fire, which generally takes up about an equal length of time, and afterwards hung up, or thrown upon a rack, until they are wanted.

BADGER, the name of an animal common in many parts of England, and called by several names, as a gray, a brock, a boreson, or a bauson.

Badgers are almost as pernicious to the husbandman as foxes, though not so subtle, nor so easily capable of catching their prey; but for what they are able to catch, as new-fallen lambs, young pigs, poultry, &c. they are equally bad. The way to catch and destroy them is with a springe, or a steel trap, or by digging a pit across their path, five feet deep and about four feet long, making it narrow at the top and bottom, and wide in the middle. It must be slightly covered with some small sticks and leaves, so as that the badger may fall in when he comes upon it. Some hunt them into their holes in moon-light nights, and afterwards dig them out. It also signifies a huckster in some districts.

BAG, in *farriery*, a name given to a remedy for

recovering a horse's appetite when lost. It is formed in this manner: They take an ounce of assafœtida, and an equal quantity of the powder of savin; these ingredients are put into a bag, which they fasten to the horse's bits, keeping him bridled for two hours, two or three times a day. As soon as the bag is taken off, he sometimes immediately begins to eat. The same bag will serve a long time.

BAILIEF, a superior sort of farm-servant, who has often the whole care and management of the farm. He should be a person of perfect sobriety, tried integrity, and fully acquainted with the nature and management of all sorts of farming business. See *Land Steward.*

BAIT, a feed of oats, or any other material given to an animal employed in travelling or labour. These should always be proportioned to the condition of the animal, and the nature of the labour; but should never be too large at a time.

It also signifies any thing applied with the view of catching an animal.

BAITING, the act of giving an animal a feed or bait of any kind. In all cases where domestic animals are concerned, it should be performed with regularity, and to a sufficient extent.

Baiting *of Animals*, the practice of setting smaller or weaker beasts to attack or harass greater and stronger ones. This is a custom which has much cruelty in it, and which seems properly much on the decline in this country.

On this barbarous custom, Mr. J. Lawrence justly observes, that "chaining and staking down wretched captives, to be worried and torn to pieces by other animals, purposely trained for such useless barbarity, is absolutely unlawful, contrary to the light of reason, and the dictates of humanity, the foul disgrace of common sense, and never ought to be tolerated for a moment, in a government which claims to be instituted for the protection of rights, and the advancement of morality." It is further added, that "the origin of the infamous practice of baiting bulls, which had afterwards the sanction of an ignorant and barbarous legislature, is said to have been as follows: By custom of the manor of Tutbury, in Staffordshire, a bull was given by the prior to the minstrels. After undergoing the torture of having his horns cut, his ears and tail cropped to the very stumps, and his nostrils filled with pepper, his body was besmeared with soap, and he was turned out in that pitiable state, in order to be hunted. This was called bull-running; and if the bull was taken, or held long enough to pull off some of his hair, he was then tied to the stake, and baited. In this unfeeling manner, says he, was the most innocuous and useful of the animal creation treated by savage man;—by priests and legislators, in too many periods, notwithstanding their high pretensions, equally unenlightened in essentials, with the lowest of mankind."

BAKING, the art or method of preparing bread, or of forming and reducing meals of any sort, whether simple or compound, into bread. See *Bread.*

Baking *of Land*, a term applied to such kinds of land as are liable, from the large proportions of clayey or loamy matter which they contain, to become hard and crusty on the surface. It has been remarked by some farmers, where these kinds of stiff and binding lands have been sown dry, and a scud of rain has fallen before the earth had time to settle, that the crust of such lands will bake, so that the corn cannot come through, to the great damage of the crop; but that this evil does not happen if such a scud of rain be followed by cool cloudy weather, and not hot sun-shine; for then the earth does not become so hollow as to be baked. In order to prevent this, it has been proposed to roll immediately after sowing, which fastens the earth together, whereby the sun has not the power of piercing into and baking it. This is, however, a method that can only succeed in particular cases: a better practice would probably be to lessen the tenacity of such soils by the application of such substances as are capable of rendering them more open and friable, as lime, and other calcareous materials, rich earthy composts, &c.

Land of this nature should also be sown as often as possible with winter-corn, such as wheat, vetches, &c. for, if wet follow the sowing, the sun is not strong enough at that time of the year to scorch and bind the ground. This sort of ground has been found to be well adapted to the growth of vetches, and other similar green crops.

BALK, a term applied to a piece of land which has been either casually overslipped, and not turned up in ploughing; or purposely left untouched by the plough, for a boundary between lands.

BALL, in *farriery*, a well-known form of medicine, for horses or other animals, which may be passed at once into the stomach. It is a mode by which those substances which are in a solid state, may be thrown into the stomach, and which could not be properly effected in any other way.

They should be made of a long oval shape, and about the size of a small egg, being conveyed over the root of the tongue by the hand. The method of doing which is well known to farriers.

This method of administering medicines is preferable in most cases to that of drenches, as, when rightly performed, it gives the animal no fatigue; while the full dose is conveyed with certainty into the stomach, without loss or diminution.

After these forms have been prepared in a proper manner, it is necessary, when they are to be kept for some time, to have them tied up in a bladder, and rolled in some dry powder, as flour, liquorice powder, &c. in order to prevent them from sticking together. Where large quantities of balls are prepared at once, great care should be taken that the different ingredients be thoroughly incorporated with the general mass, that they may be equally divided, and not too great a proportion of one ingredient be in one ball, and too little in another; of course, when any medicine that requires nicety in the dose is ordered, every ball should be made up separately, with the exact quantity ordered in each.

ALTERATIVE BALLS.

The following formulæ have been given for this sort of balls by Mr. John Lawrence:

Take of flowers of sulphur, cream of tartar, each

half an ounce; canella alba, in powder, one drachm; treacle, enough to make a ball: half or the whole of which may be given twice a-day, fasting.

Take of flowers of sulphur, cream of tartar, gum guaiacum, turmeric, each two drachms; canella alba, one drachm: make them into one or two balls with treacle, giving them as above.

Take of prepared antimony, gum guaiacum, each from three to four drachms: make these into a ball with treacle, giving one every day.

Take of antimonial æthiops, four to six drachms; treacle enough to make a ball: giving it every night for a fortnight; then omitting it for a week, and afterwards resuming its use again.

These have likewise been recommended by Mr. White:

Take of levigated antimony, six ounces; flowers of sulphur, eight ounces: mix them into a mass with treacle, and divide it into eight balls.

Take of powdered rosin, four ounces; nitre, three ounces; tartarised antimony, one ounce; treacle, a sufficient quantity: make them into a mass, and divide it into eight balls.

Take of unwashed calx of antimony, two ounces; calomel, two drachms; powdered aniseeds, four ounces: make them into a mass with treacle, dividing it into eight doses.

Take of calomel, half a drachm; aloes, one drachm; castile soap, two drachms; oil of juniper, thirty drops; powdered aniseeds, half an ounce: make them into a ball with syrup.

Mr. Taplin has the following useful formulæ of this kind:

Take of levigated antimony, flowers of sulphur, nitre, each three ounces; Castile soap, ten ounces; oil of juniper, three drachms; honey, enough to make a mass: divide it into twelve balls, giving one every morning for three or more weeks, in the grease, after purging.

Take of milk of sulphur, prepared antimony, cream of tartar, cinnaber of antimony, each five ounces; Æthiop's mineral, four ounces; honey, sufficient to make a mass: divide it into a dozen balls, giving one every morning in the fa. cy.

ASTRINGENT BALLS.

Of this sort, the following formulæ are by the same writer:

Take of diascordium, six drachms; gum arabic, prepared chalk, Armenian bole, each half an ounce; ginger, one drachm; oil of aniseed, forty drops; syrup, enough to make a ball; which may be given in cases of a lax or scouring, and repeated in six, eight, or twelve hours, as may be necessary.

Take of rhubarb, compound powder of gum-tragacanth, each half an ounce; colombo, ginger, each one drachm; opium, fifteen grains; conserve of orange-peel, six drachms; syrup of poppies, sufficient to form a ball: to be given as there may be occasion.

Take of mithridate, one ounce; Armenian bole, gum-arabic, prepared chalk, each half an ounce; ginger, two drachms; syrup of poppies, sufficient to make a ball.

CORDIAL BALLS.

The first of these formulæ is given by Mr. Ryding, and the others by Mr. White:

Take of grains of paradise, in fine powder, two ounces; ginger, canella alba, each half an ounce; aniseeds, carraway seeds, each an ounce and a half; liquorice powder, two ounces; honey, a sufficient quantity to form eight balls; one to be given as there may be occasion.

Take of cummin seeds, aniseeds, carraway seeds, each four ounces; ginger, two ounces; make them into a mass with treacle, giving about two ounces in a ball.

Take of aniseeds, carraway seeds, sweet fennel seeds, liquorice powder, each four ounces; ginger, cassia, in powder each an ounce and a half: form them into a mass with honey, giving for a dose about two ounces.

Compositions of this sort may be much varied, according to the taste of the prescriber.

DIAPHORETIC BALL.

The following formula is given by Mr. White:

Take of opium, one drachm; camphor, two drachms; tartarised antimony, three drachms; powdered aniseeds, half an ounce; syrup, sufficient to make a ball.

DIURETIC BALLS.

Of this sort of ball, Mr. R. Lawrence has this formula:

Take of Venice turpentine, half an ounce; tartarised antimony, two drachms; liquorice powder, one ounce: form them into a ball with treacle.

The following are by Mr. White:

Take of Castile soap, four ounces; powdered rosin, nitre, each two ounces; oil of juniper, half an ounce; linseed powder, and syrup, enough to give the mass a proper degree of solidity: divide it for strong horses, into six balls; and, for weak ones, into eight.

Take of Castile soap, four ounces; Venice turpentine, two ounces; powdered aniseeds, a sufficient quantity: with treacle make them into six balls.

And Mr. Ryding has the following:

Take of yellow rosin, Castile soap, Venice turpentine, each one pound: dissolve them slowly over the fire, and when sufficiently incorporated, form the mass into balls of from an ounce to an ounce and a half.

He gives them in gripes, swelled legs, grease, and in diseases of the eyes, &c.

PURGING BALLS.

Of this sort of balls, Mr. Taplin has given the following formula:

Take of succotrine aloes, one ounce; rhubarb, two drachms; jalap, cream of tartar, each one drachm; ginger, two scruples; oil of cloves, oil of aniseed, each twenty drops; syrup of buckthorn, sufficient to form a ball.

And Mr. White has these:

Take of succotrine aloes, five drachms; prepared natron, two drachms; aromatic powder, one drachm; oil of carraways, ten drops: form them into a ball with syrup.

Take of succotrine aloes, seven drachms; Castile soap, half an ounce; ginger, one drachm; oil of carraways, ten drops: form them into a ball with syrup.

Take of succotrine aloes, one ounce; prepared natron, two drachms; aromatic powder, one drachm; oil of aniseed, ten drops; syrup, sufficient to form a ball.

Mr. Ryding has likewise the following useful formulæ of this sort:

Take of Barbadoes aloes, in powder, six drachms; ginger, one scruple; soft soap, a sufficient quantity to form a ball.

Take of Barbadoes aloes, in fine powder, half an ounce; calomel, one drachm; mucilage of gum-arabic, sufficient to form a ball.

And Mr. John Lawrence gives the following:

Take of succotrine aloes, from twelve to fourteen drachms; cream of tartar, from one to two ounces; powdered ginger, a tea-spoonful; olive oil, a table-spoonful; syrup of buckthorn, or treacle, a sufficient quantity: form them into two or three balls, according to the purpose intended.

Another formula is given by Mr. R. Lawrence:

Take of Barbadoes aloes, nine drachms; ginger, one drachm: form them into a ball with treacle or syrup.

RESTORATIVE BALLS.

The following formulæ of this nature, are given, the first by Mr. Ryding, and the others by Mr. Taplin:

Take of Peruvian bark, half a pound; grains of paradise, two ounces; gentian, columbo, each three ounces; honey, enough to make a mass: to be divided into sixteen balls; giving one every morning in cases of indigestion.

Take of Peruvian bark, four ounces; mithridate (or diascordium), two ounces; canella alba, snake-root, camomile, each, in powder, one ounce: make them into a mass with honey, dividing it into six balls, giving one night and morning.

Take of Venice treacle, half an ounce; Peruvian bark, six drachms; columbo, camomile, in powder, each two drachms; oil of carraways, twenty-five drops; honey sufficient to make a ball.

This sort of ball may be readily formed by simply joining any of the aromatic powders with bark.

It is obvious that most sorts of powders used in veterinary practice, may be made into balls, if they be thought better to be given in that way: and it is observed by Mr. John Lawrence, that it is better to give two small balls than one of any great bulk, as accidents have happened from the latter circumstance: which he gives by twisting them up together in a piece of soft paper, and dipping them in oil.

BALLARD, a provincial term used in Devonshire to signify a castrated ram.

BANDAGE, in *farriery*, a long narrow slip, or fillet, of flannel, cotton, or linen, made use of by veterinary surgeons, to retain dressings, &c. upon wounds, as well as to assist their healing by its gentle uniform mechanical pressure. But this is a form of bandage, however, that can only be applied to the extremities of animals with the latter view; as the successive turns of it require to be accurately laid over each other, which cannot be observed where the injured part presents an inequality of surface. An elbow-bandage has been advised by Mr. Taplin, (the elbow-portion of an old waistcoat-sleeve,) which is well adapted to many purposes in farriery.

In cases such as fractures, where the parts should be kept firmly in their place, bandages of stiffer materials should be used; and sometimes outer covers of leather, to which numerous straps and small buckles are fixed.

All sorts of bandages should be applied with the greatest exactness and nicety.

BANDS, the pieces of straw by means of which the sheaves are bound together after the grain has been reaped. They are usually formed from a small parcel of the tallest grain-stems taken from the grips, by twisting them together at the ear-ends.

Bands, where the straw is tender, should be made in the morning, that they may not crack; for the straw will not twist so well after the sun is up, but will be brittle, and break off below the ears. The turning of three or four of the stubble or bottom ends of the straw to the ears of the band sometimes tends greatly to add to their strength and toughness.

The bands for the sheaves should not be spread out, except in fair weather, because, being pressed down by the grips, which it is necessary to lay upon them to keep them in their places, they will grow sooner than any other part of the corn if rain should come; for they cannot dry, on account of their lying undermost. But though the bands may be made while the morning dew is upon them, the sheaves ought never to be bound up wet; for, if they are, they will certainly grow mouldy.

Farmers should always attend to the binding up of their sheaves, and not suffer the reapers, for sake of dispatch, to tie them just underneath the ears, instead of binding them near the other end; as, where such a practice is adopted, they will hardly hold together to be flung into the cart, and will certainly be in great danger of falling to pieces before they are thrashed.

If rain be apprehended in harvest-time, it is best to bind the grips into sheaves as fast as they are made; because even small showers will do much harm, by preventing their being bound up.

Some sorts of grain bear wet weather with much less injury than others, as barley, and some kinds of oats; but it is a good practice to bind them all up as quickly as possible, and especially wheat. This sort of grain should indeed never be cut when wet, if it can possibly be avoided.

Bands *of a Saddle*, are two pieces of iron, made flat, and three fingers broad, nailed upon the bows of a saddle, one on each side, contrived in such a way as to hold the bows in the situation that makes the form of the saddle.

BANE, a disease in sheep, the same as rot. See *Rot.*

BANGLE-EARS, an imperfection in the ears of horses, which some have attempted to remedy in the following manner: Place the ears as you would have them stand, and then, with two little boards or pieces of trenchers, three fingers broad, having two long strings fastened to them, bind them so fast in the places where they stand that they cannot stir; then pull up with your finger and thumb, and cut or clip away with a pair of sharp scissars, all the empty skin about the roots of the ears close by the head; and, with a needle and silk, stitch the two outsides of the skin together, and let the wound heal: when this is done, take away the splints that hold up the ears, and in a little time they will frequently keep the places where they were fixed without alteration.

BANK, in *agriculture*, a heap or mound of earth, piled up to keep the water of rivers, lakes, or the sea, from overflowing the grounds which are situated contiguous to them on the inside. See *Embankments.*

BANQUET, is the small part of the branch of a bridle that is under the eye, which, being rounded like a small rod, gathers and joins the extremities of the bit to the branch, in such a manner that the banquet is not seen, but covered by the cap, or that part of the bit which is next the branch.

BAR, a narrow flat piece of wood or iron, used for fastening doors, gates, and other purposes.

To Bar *a Vein*, in *farriery*, a vulgar term, which implies an operation performed in the following manner: The skin, above and below the place where the operation is to be performed, is opened, and, after freeing the vein from the surrounding parts, it is tied on each side with ligatures: and the vein then opened between them, in order to discharge the blood. It is performed in the disease called the blood-spavin, upon the varicose veins of horses' legs, and sometimes other parts of their bodies, but appears to be an operation of very limited utility.

BAR-SHOE, a particular kind of shoe which is connected at the heel. See *Shoeing.*

BARB, a general name for horses imported from Barbary.

The chest of the barb is long and slender, rises beautifully from the withers, his mane little, his head well shaped, small, and lean; his shoulders flat and slender; his withers narrow and plump; his back straight and short; and his flanks and sides round, not bellying out; his haunches firm and well shaped; his croup generally somewhat long, and his tail placed pretty high; his thigh well shaped, and seldom flat; his leg handsome, well shaped, and without long hair at the pastern joint; his foot well made, but his pastern often long.

Barbs are of all colours, but most generally brown. They are somewhat negligent in their going; but, properly encouraged, show an amazing swiftness and vigour; they are very light and fit for running, and seem, of all others, the fittest to breed from. It were, however, to be wished that they were a little taller, the largest barely exceeding fourteen hands; and one of fourteen hands and an inch is very extraordinary. Experience has, however, shown, that in England, France, &c. stallions of this breed get colts larger than themselves. Among these horses, those from the king of Morocco's dominions are accounted the best, except the mountain barbs. Those of the rest of Mauritania are inferior to them, as are also those of Turkey, Persia, and Armenia. Those breeds of horses that are brought from hot climates have in general smoother coats than others.

BARBELS, in *farriery*, the knots or excrescences of superfluous flesh, which grow up in the channels of the mouths of horses, or in the intervals that separate the bars and lie under the tongue. They are sometimes termed Barbs. These sometimes take place in black cattle as well as horses, and prevent their feeding.

They are cured, both in horses and cattle, by cutting them close off with any kind of sharp instrument, and sometimes by burning with a hot iron.

BARBERY, a plant of the shrub kind, which is sometimes planted for the purpose of a hedge or fence, as it grows very thick and branching quite to the bottom, and has the armour of small thorns or prickles. It has been supposed by some to cause the mildew in wheat, when growing within a short distance of the crop. And Mr. Young, in the seventh volume of the Annals of Agriculture, gives the following instance in a letter from Mr. Macro: "Having heard by several farmers, says he, that wheat would mildew where a barbery-bush grew, I concluded it was only because the soil on which they naturally grew was likewise the most natural to that distemper; I therefore sent for a plant at the distance of a mile or two,

(not having any of them on my farm) and planted it on a rich soil with a clay bottom. The bush grew well, and I, three years following, planted wheat round it: the first year, in the month of October; the second in the month of August; and the third in September; and all were so completely mildewed, that the best of the little grain it produced, was only about the size of rye, and that without any flour." This was planted in his garden, and consequently more likely to mildew than on old wheat-land. He, however, planted some on the opposite side of the garden, one of the years, which produced very good grain, although the straw was a little mildewed.

Mr. Marshall, in his Rural Œconomy of Norfolk, on the same subject, says, "it has long been considered as one of the first of vulgar errors among husbandmen, that the barbery-plant has a pernicious quality of blighting the wheat which grows near it.

This idea, says he, whether it be erroneous or founded on fact, is no where more strongly rooted than among the Norfolk farmers; one of whom mentioning, with a serious countenance, an instance of this malady, he very fashionably laughed at him. He, however, stood firm, says Mr. Marshall, and persisted in his being in the right; intimating, that so far from being led from the cause to the effect, he was, on the reverse, led from the effect to the cause: for, observing a stripe of blasted wheat across his close, he traced it back to the hedge, thinking there to have found the enemy; but being disappointed, he crossed the lane into a garden on the opposite side of it, where he found a large barbery-bush in the direction in which he had looked for it. The mischief, according to his description, stretched away from this point across the field of wheat, growing broader and fainter, like the tail of a comet, the further it proceeded from its source. The effect was carried to a greater distance than he had ever observed it before; owing, as he believed, to an opening in the orchard behind it to the south-west, forming a gut or channel for the wind.

Being desirous of ascertaining the fact, he inquired further among intelligent farmers concerning the subject.—They are, says he, to a man, decided in their opinion as to the fact; which appears indeed to have been so long established in the minds of principal farmers, that it is now difficult to ascertain it from observation; barbery-plants having (of late years more particularly) been extirpated from farm-hedges with the utmost care and assiduity. One instance, however, of mischief he had related to him, and another he was himself an eye-witness to. Mr. Barnard, of Bradfield, observed, that on seeing a patch of his wheat very much blighted, he looked round for a barbery-bush; but, seeing none conspicuous in the hedge, which was thick, he with some difficulty got into it, and there found the enemy. He was clearly decided as to the fact. And Mr. Gibbs, of Rowton, on telling Mr. Marshall that a patch of his wheat was blighted in the same manner, and that he believed it to proceed from some sprigs of barbery which remained in the neighbouring hedge (which, a few years ago, had been weeded from it,) he went to inspect the place; and true it was, says he, that near it we found three small plants of barbery, one of which was particularly full of berries. The straw of the wheat, says he, was black; and the grain, if it may be so called, a mere husk of bran; while the rest of the piece was of a much superior quality. To endeavour to ascertain the truth of this opinion still more fully, he had a small bush of the barbery-plant set, in February or March, in the middle of a large piece of wheat. He, however, neglected to make any observations upon it until a little before harvest; when a neighbour, Mr. Baker, of South-Reps, came to tell him of the effect it had produced. The wheat was then changing, and the rest of the piece (about twenty acres) had acquired a considerable degree of whiteness (white wheat); while about the barbery-bush there appeared a long, but somewhat oval-shaped, stripe, of a dark livid colour, obvious to a person riding on the road at a considerable distance. The part affected resembled the tail of a comet, the bush itself presenting the nucleus; on one side of which the sensible effect reached about twelve yards; but, on the other, not more than two yards; the tail pointing towards the south-west: so that probably the effect took place during a north-east wind. At harvest, the ears near the bush stood erect, handling soft and chaffy; the grains slender, shrivelled and light.—As the distance from the bush increased, the effect was less discernible, until it vanished imperceptibly.

The rest of the piece was a tolerable crop; and the straw clean, except on a part which was lodged; where the straw nearly resembled that round the barbery; but the grain on that part, though lodged, was much heavier than it was on this, where the crop stood erect. The grain of the crop, in general, was thin-bodied; nevertheless, ten grains, chosen impartially out of the ordinary corn of the piece, took twenty-four of the barberied grains, chosen equally impartially, to balance them; so that, supposing the crop in general to be worth five pounds an acre, the part injured by the barbery would barely be worth forty shillings; the quality, as well as the quantity, being much inferior.

If these statements be well founded, care should be taken not to plant this kind of shrub in the hedge-rows of such lands as are under an arable system of management. It may, however, be used as a good live fence for lands in a state of pasture. Mr. Croker, in the third volume of the Bath Papers, remarks, that the roots of this shrub, when boiled in lye, dye wool yellow; and that in Poland they dye leather of a most beautiful yellow with the bark of the root.

BARFAN, a provincial term used to denote a horse-collar in Yorkshire.

BARING *Roots of Trees*, a practice formerly much adopted, but which later experience has shown to be highly injurious and hurtful to their growth, as well as, in fruit-trees, prejudicial to their bearing, except where the canker is to be removed from them.

BARK, the exterior part of trees, serving them for a skin or coat. It is covered by a cuticle or epidermis, which forms the external part. The bark itself is of a hard texture, and loosely adheres in trees to the liber or inner bark.

According to Dr. Darwin, the barks of the trunks

of trees are similar to those of their roots, and may be esteemed a part of them, as they consist of an intertexture of the vessels, which descend from the plume of each individual bud, to the radicle of it, and constitute its caudex. The bark, nevertheless, of the root is furnished with lymphatics to absorb water and nutricious juices from the earth, and is covered with a moister cuticle; while the bark of the stem is furnished with lymphatics to absorb moisture from the air, and is covered with a drier cuticle; the latter resembling the external skin of animals, and the lymphatics, which open upon it; and the former resembling the mucous membrane of the stomach, and its lacteals.

The interior barks of some trees, like the alburnum or roots above-described, contain much mucilaginous or nutricious matter; as the bark of elm, ulmus, and of holly, ilex; and probably of all those trees or shrubs which are armed with thorns or prickles, which are designed to prevent the depredations of animals on them, as the hawthorn, gooseberry, and gorse, cratægus, ribes grossularia, ulex. The internal barks of these vegetables may be conceived to be their alburnum less indurated, and might probably all be used as food for ourselves or other animals in years of scarcity, or for the purpose of fermentation; as he doubts not but the inner bark of elm-trees, ulmus, detracted in the spring, by being boiled in water, might be converted, by the addition of yest, into small beer, as well as the alburnum of the maple and birch, acer and betula; all which are now suffered to be eaten by insects when those trees are felled.

For the sugar, which is extracted from the vernal sap-juice of the maple and birch, as well as that found in the manna-ash, fraxinus ornus, seems to reside during the winter months in the root or alburnum, rather than in the bark properly so called; and to become liquefied, as above-mentioned, by the warmth of the spring, or dissolved by the moisture absorbed from the earth, and conveyed to the opening buds; but resides solely in the roots of perennial herbaceous plants: and in the œconomy of grasses, and he supposes of the sugar-cane, it is deposited at the bottom of each joint, which is properly the root of the stem above it.

Of these, the bark of the holly not only yields a nutritious mucilage, and thus supplies much provender to the deer and cattle in Needwood-forest, by the branches being cut off, and strewed upon the ground, in severe seasons of frost, and snow; but contains a resinous material, which is obtained by boiling the bark and washing away the other parts of it. This resinous material possesses a great adhesiveness to feathers, and other dry porous bodies, and has hence obtained the name of bird-lime, and much resembles the caoutchouc or elastic resin brought from South America, and also resembles a fossil elastic bitumen found near Matlock in Derbyshire, both in its elasticity and inflammability. Hollies may be worth cultivating for this material, besides the uses of their wood, as the doctor was informed, that thirty years ago a person who purchased a wood in Yorkshire, sold to a Dutch merchant, the bird-lime, prepared from the bark of the numerous hollies, for nearly the whole sum given for the wood; which, if it could be hardened, might probably, he says, be sold for the elastic resin above-mentioned. Whether this resembles the nutritive resinous material found in wheat-flour, when the mucilage and starch are washed from it, might, he thinks, also be worth inquiry.

Other barks contain bitter, resinous, aromatic, or acrid materials, which supply the shops of medicine, as Peruvian bark, cascarilla, cinnamon, and were designed by nature to protect those vegetables from the depredations of quadrupeds or insects. Hence many trees, and even the wood of them, after it is dried and made into domestic furniture, is never devoured by worms, as the mahogany, cedar, cypress; and hence many plants, as the fox-glove, digitalis; houndstongue, cynoglossum; hen-bane, hyoscyamus; and many trees are not devoured by any animals; as their juices would be poisonous to them, or much disagree with their stomachs, if their disgustful flavours to the nose or palate did not prevent their eating them. The same defence of the vegetable kingdom from human digestion, except those which have, in long process of time, been selected and cultivated, appears from the relation of some unfortunate shipwrecked travellers, who have passed some hundreds of miles along uninhabited countries, almost without finding an esculent vegetable production.

Other barks contain restringent or colouring particles, employed in the arts of dyeing and tanning, as barbery, oak, and ash, berberis, quercus, fraxinus. The art of tanning consists in filling the pores of the animal mucous membrane with these restringent particles found in some vegetables, which are believed to possess a quality of shortening animal fibres. Thus, when a long hair is immersed some time in a solution of the bark of oak, or of the galls produced on its leaves by the punctures of insects, the hair is said to be shortened. Whether this process be occasioned by chemical coagulation of the mucus, of which these fibres totally or in part consist, or by capillary attraction tending to distend these fibres in breadth, and thus to shorten them, as a twisted string is shortened by moisture, has not yet been well investigated. By thus impregnating the pores of animal skins with vegetable particles, they become less liable to putrefaction, as consisting of a mixture of animal and vegetable matter, as well as much better adapted to many domestic or mechanical purposes.

The art of dyeing consists likewise in impregnating the pores of dry substances with a solution of the colouring matter extracted from vegetables by the capillary attraction of those pores to the coloured solution. And, secondly, by a chemical change of those colouring particles after they have been imbibed, and the water of the solution exhaled, by again steeping them in another solution which may chemically affect the former. Thus, as green consists of a mixture of blue and yellow, it may be best produced by boiling the material designed to be dyed, first in a decoction of one of these colours, as of indigo; and then in that of another, as of the bark of barbery. And as a solution of iron becomes black when mixed with a decoction of oak-galls, by being in part precipitated;

it is probable, that the particles of this combination, of a solution of iron with restringent matter, may be larger than either of those particles separately; and therefore that, if a dry porous substance be immersed first in a decoction of oak-galls, and, after being suffered to dry, is then immersed in a solution of iron, the black tinge will penetrate into minuter pores, and thus become more intense than if the substance had been immersed in the black dye already prepared.

Other barks are used for apparel, paper, cordage, and for many mechanical purposes, owing to the strength and tenacity of their fibres, or to the fineness of them; as hemp, cannabis; flax, linum; for the purposes of spinning and weaving. The bark or leaves of the papyrus, a flag of the Nile, was first used for paper; and the bark of the mulberry-tree is still made into cloth at Otaheite, and other southern islands.

The art of separating the fibres of the bark of plants, as they consist of the caudexes of buds, or the connecting vessels between the plumules and the radicles of them, is performed by soaking them some weeks in stagnant water, till the mucous membranes, which connect these fibres, are destroyed by putrefaction; and afterwards by drying them, and beating off with hammers what may still adhere.

These fibrous parts of the barks of trees, as they contain no saccharine matter, like the alburnum, are much less liable to decay than the sap-wood, or perhaps than any part of the timber. Maupertuis, who went to Lapland to measure a degree of the meridian, says, that among the numerous trees which lay upon the ground destroyed by age, or blown down by the winds, many birch-trees appeared whole, owing to the undecayed state of their bark; but crumbled into powder on being trod upon; and that the Swedes took the practice from this of covering their houses with this unperishable bark, on which they sometimes lay soil, and thus possess aerial gardens.

To increase the quantity of bark, it must be remembered that the leaf-buds, or viviparous offspring of trees, as they form new buds, acquire new caudexes extending down into the ground, and thus increase the bark of the stem in thickness; but the flower-buds acquire no new caudexes, but die as soon as they have ripened their seed, and consequently do not increase the thickness of the bark. Whence one method of increasing the quantity of the bark is to increase the number or vigour of the leaf-buds in contradistinction to the flower-buds, which may be done by pinching off the flowers as soon as they appear; and, as the bark becomes gradually changed into wood, this may be one method also of forwarding the growth of timber trees.

The method of preserving the bark of trees from moss, consists in rubbing off that parasite vegetable in wet weather by means of a hardish brush; which is said to be used with advantage on the apple-trees in the cyder countries; and may, at the same time, give motion to the vegetable circulation, or forward the ascent of their juices absorbed by the radical or cortical absorbents. In dry weather the brush should be frequently dipped in water. Washing the barks of wall-trees by a water-engine may also facilitate the protrusion of their buds in dry seasons; and might possibly prevent the canker, if applied to dwarf or espalier apple-trees. Other parasite vegetables must be occasionally destroyed, where they occur, as the lichens, fungi, misletoes; with the ivies and other climbers, as some kinds of lonicera, clematis, and fumaria, woodbine, virgin's bower, and fumitory.

When a wound is made in the bark so as to expose the alburnum to the air, the upper lip of the wound is liable to grow faster downwards than the lower one is to grow upwards, owing to the former being supplied directly with nutritive juices secreted from the vegetable blood, after its ventilation, and consequent oxygenation in the leaves; whereas, the lower lip only receives those juices laterally by inosculation of vessels. Over these wounds the cuticle is liable to project, and to supply a convenient hiding-place for insects, which either eat the new fibres of the growing bark, and perforate the alburnum; or by their moisture, their warmth, and their excrements, contribute to the decay of the alburnum, and prevent the healing of the wound. These dead edges of the projecting bark or cuticle should be nicely cut off, but not so as to wound the living bark.

Plasters of lime, or of tar, with sublimate of mercury, have been recommended to preserve the wounded parts from the air, and from moisture, and from insects; but, as all these materials are injurious to the fibres of the living bark, they should be used with caution, so as not to touch the edges of the wound, but only to cover the alburnum: for this purpose white lead and boiled oil, mixed into a thick paint, or with the addition of sublimate of mercury, or of arsenic, or of spirit of turpentine, may probably answer the purpose; and may be of real utility on the wounds of those trees whose wood contains less acrimony, and is therefore more liable to be bored into and eaten by a large worm or maggot, almost as thick as a goose-quill: which he has seen happen to a pear-tree, so as to consume the whole internal wood, till the tree was blown down.

In respect to the caution necessary to be observed in not touching the living edges of the wounded bark with such materials as may injure the tree by their absorption, he remembers seeing several young elm trees, which died by their boles having been covered, as he was informed, by quick-lime mixed with cow-dung to prevent their being injured by horses; and he has seen branches of peach and nectarine trees destroyed by sprinkling them, when in leaf, with a slight solution of arsenic, and others with spirit of turpentine.

A more curious method of cure is said to have succeeded, where the bark of a tree has recently been torn off, even to great extent; and that is by binding the same piece of bark on again, or another piece from the same tree, or from one of a similar nature, nicely adapting the edges of the bark to be applied, to the edges of that which surrounds the wound of the tree, which, it is said, will coalesce in the same manner as the vessels of the bark of an ingrafted scion unite with those of the bark of the stock ingrafted on; which is strictly analogous to the union of inflamed or wounded parts of animal bodies, as in the

cure of the hare-lip, or the insertion of the living tooth from the jaw of one person into another, or the factitious noses of Taliacotius.

If the bark over the cankered parts of apple-trees, says the doctor, could be thus renewed by paring the edges of the mortified bark to the quick, and then nicely applying a piece of healthy bark from an apple-tree of inferior value, and securing it with an elastic bandage, as a shred of flannel, it would be a very valuable discovery. Another method, where a branch of a valuable tree is in the progress of being destroyed by canker, might be by inclosing the cankered part, and some inches above it, in a garden-pot of earth previously divided, and supported by stakes, and tied together round the branch; which might then strike roots in the earth of the garden-pot, and, after some months, might be cut off, and planted on the ground, and might thus be preserved, and produce a new tree; which experiment, the doctor says, he has this summer tried on two apple-trees, and believes it will succeed.

The bark of trees in general, and especially that of the oak, becomes an useful manure after it has been employed by the tanner in the preparation of leather. One load of oak-bark laid in a heap and rotted, after it has been thus used, it is said, will do more service to stiff cold land, and its effects will last longer, than two loads of the richest dung. Mr. Miller observes, that it is much better for cold strong land than for light hot ground, if it be used alone, as taken from the tan-yard; because it is of a warm nature, and will loosen and separate the earth so effectually, that, by only using it two or three times, a strong soil, not easy to be wrought, may be rendered perfectly light and loose: but, by mixing it with earth of a nature contrary to that which it is intended to correct, and in a proportion suited to the nature of the soil it is to be laid on, it will prove a good manure for almost any land; and Mr. Mortimer asserts, that it will alter and change the very nature of the soil, and turn it into a very rich black mould. As it abounds with vegetable matter, derived from the tree to which it belonged, and is strongly impregnated with animal materials by the length of time which it remains in the tan-vats, with the skins and hides of animals, must necessarily prove beneficial as a manure.

When laid on grass-land, it has been recommended to be spread soon after Michaelmas, that the winter rains may wash it into the ground: as, when laid on in the spring, it is apt to burn the grass, and, instead of improving, do it considerable injury for that season. But when used for corn-land it should be spread before the last ploughing, that it may be turned down so as that the fibres of the corn may reach it in the spring; for, when it lies too near the surface, it has been supposed to forward the growth of the crop at too early a period, and to be nearly consumed in the spring, when the nourishment is chiefly wanted.

Mr. Bradley advised a gentleman, to whom a considerable quantity of bark was left upon the expiration of the lease of a tan-yard, to lay some of it upon a piece of stubborn sour land; which he did with such success, that his product was admired by all the gardeners and farmers in the neighbourhood. Fo such ground, he thinks it should be mixed with a sandy soil or earth; and that one-third of bark to two-thirds of such materials will be a sufficient proportion for clays; laying on about one hundred and fifty cart-loads upon an acre.

And Worlidge says, that the barks or rinds of other trees, though not of so high a value as that of the oak, which is the sort principally used by tanners, must, of necessity, enrich either corn or pasture-ground, if broken into small pieces, and laid upon it.

By mixing caustic lime with tanner's bark, in the proportion of two parts of the latter to one of the former, the conversion of the bark into vegetable mould has been found to be greatly promoted; and the composition, when employed as a top-dressing for turnips and grass, has proved an excellent manure.

BARK-BOUND, a disease which has been supposed common to fruit and other trees, and to be capable of being cured by making a slit through the bark, from the top of the tree to the bottom, in February or March; and, where the gaping is pretty considerable, to fill it up with cow-dung, or other similar composition.

BARKER, a term used provincially in Devonshire, to signify a rubber or whetstone.

BARKING *of Trees*, the operation of stripping off the bark or rind, which, when taken from some kinds of trees, as the oak, elm, &c. is used by the tanners.

It is common in this climate to perform this operation in the month of May, as, at that season, the bark, by the rising of the sap in great quantity, is easily separated from the wood. This renders it necessary to fell the trees in that month; by which the timber is much less valuable than it would be if they were felled after the falling of the leaf.

Dr. Darwin, in his Phytologia, observes, that as the sap-juice rises in all deciduous trees during the vernal months to expand their foliage, though probably in greater quantity in some trees than in others, it must consist not only of sugar and mucilage, as in the maple and birch, but of various other different ingredients in different trees, which have not been attended to; as appears from the taste of their young leaves, as of oak or ash. And as some of these materials reside in the roots and sap-wood or alburnum, so others of them may perhaps reside in the bark, where they have been deposited during the preceding summer, and become lignified by the warmth of the spring, or dissolved by the moisture absorbed from the earth and air, and conveyed upwards to the opening buds; whence it is evident that the barks of trees should be taken off for use in winter, or in early spring, before their buds begin to expand; as then a part of these nutritious juices, or of the other materials, which are required for medecines, or in the arts of dyeing and tanning, are, in part, extended on the young leaves; which generally possess the taste and qualities of the bark, though in a less degree.

It may, nevertheless, be observed, that all these astringent or other materials may reside in the alburnum of the trunk or roots of all perennial vegetables, as well as in their barks; because the young leaves,

which pullulate on decorticated oaks, have the same bitter flavour as the leaves on those which have not been decorticated; which may in part be derived from the bark of the root, which is still in the ground, and be carried up the vessels of the sap-wood to the new buds.

Hence the bark of oak-trees should be taken off during the winter; but when the sap-juice, residing or ascending in the vessels of the alburnum, becomes more liquefied by the warmth of the spring, or is mixed with moisture, and pushed up with great force by the absorbent vessels of the roots, it oozes out, in some degree, between the alburnum and the bark; and thus the bark becomes so much more readily separated from the sap-wood; whence this business is generally done early in the spring, and should be performed as soon as this facility of detracting the bark appears; because this process of the germination of the buds continues to injure the bark, whether the tree be cut down or not; as the buds expand their foliage on new-felled trees, as they lie on the ground.

Mr. Marshall, in his Rural Œconomy of Yorkshire, says, that the peeling of oak timber in that county is generally done by the day; the labourers being, he believes, invariably employed by the timber-merchant, not by the tanner; practices which are productive of a considerable saving of bark. Men working by the ton or quarter, or tanners paying by weight or measure, will not peel the boughs sufficiently near; it is against their interest to do it. But it is the interest of the timber-merchant, or of the tanner, if he purchase by the gross, or by the ton of timber, to peel so long as the bark will pay for the labour. This, he says, accounts for the smallness of the twigs which are peeled in that county: if the bark run freely, twigs not much thicker than the finger are frequently stripped.

The tool commonly made use of, in most counties, is made of bone or iron. If of the former, the thigh or shin-bone of an ass is preferred, which is formed into a two-handed instrument for the stem and larger boughs, with a handle of wood fixed at the end. The edge once given by the grinding-stone, or a rasp, keeps itself sharp by wear.

According to Mr. Nicol, three descriptions of people are employed in this business, the *hag-men* or cutters, the carriers, and the barkers. "The latter chiefly consist of women and children. The cutters should be provided with ripping-saws widely set, with sharp, light hatchets, and with short-handled pruning-hooks. The carriers should be provided with short ropes, stout limbs, and broad shoulders. The barkers are provided with light, short-handled, ashen mallets, the head being about eight inches long, three inches diameter in the face, and the other end blunt, somewhat wedge-shaped; with sharp ashen wedges, somewhat spatula-shaped, and which may either be drove by the mallet, or, being formed with a kind of handle, may be pushed with the hand; and with a smooth-skinned whin, or other land-stone, the size of one's head." And it is added, that "the cutters are divided into two parties: hatchet-men, who sever the stem; and hook-men, who prune it of small twigs, and cut it into convenient lengths. The carriers bundle the small branches (all an inch in diameter are barked) into their ropes, and bear them, the large ones, and the trunk, if liftable by one person, to the barkers, who are seated on the grass at a convenient distance. Small branches and twigs are held by one hand on the stone, and beat with the mallet until the bark be split, which is then stript off, and laid regularly aside, as in reaping of corn, till a bundle of convenient size be formed. The trunk and branches as large as the leg, &c. are laid along on the ground; the upper side is beat, with force, from one end to the other; the bark is then started, at the thick end, by thrusting or driving in the wedge, which, being run along the whole length, rips it open in an instant; the wedge is applied on both sides of the incision, in the manner of the knife in skinning a sheep, observing to beat before its point with the mallet until the bark is completely loosened. Thus, says he, a skilful barker will skin a tree or branch as completely as a butcher a beast. But, the point most particularly to be observed in this art is, to take off the bark in as long shreds or strands as possible, for the conveniency of carriage to, and drying it on the horses. These are formed of long branches; and pieces of a yard in length, sharpened at one end, and having a knag at the other to receive and support the end of the former. Two knags are driven into the ground at the distance of a foot from each other, until their upper ends are within thirty inches of it, and on a level; other two are placed in like manner, at a distance suitable to the length of two straight branches, which are laid on, parallel to each other; thus forming the horse, or support for the bark."

It is observed, that "the horses may stand within four or five feet of each other, and are always to be placed on a dry, elevated spot, that the bark may have free air, in drying." And that, "at the end of each day's work, the bark is carried to, and laid on the horses; across, and to the thickness of about six or eight inches. The large boardy pieces are set up on end, leaning against the horses, or being formed into small pyramidal stacks. Due attention must be paid to turning the bark once, or perhaps twice a day, according to the state of the weather. Good hay weather is good for barking. Gentle showers are beneficial; but long continued rains are productive of much evil; nor is the bark the better for being dried too fast." He adds, that "a careful hagman will take pains to lay the strong boardy pieces of the trunk in such a manner as to shoot off the wet, in continued rains, from the smaller bark of the extremities; at the same time, preserving, as much as possible, the colour of the inner bark, and, consequently, the value of the whole, by turning the natural surface outwards. For, it is chiefly by the high-brown colour of the inner rind, and by its astringent effect upon the palate, when tasted, that the tanner or merchant judge of its value. These properties are lost, if, through neglect, or by the vicissitudes of the weather, the inner bark be blanched," or rendered white by the weather.

After it becomes "in a proper state, that is, completely past fermentation, if it cannot conveniently be carried off the ground and housed, it must be

stacked. An experienced husbandman who can stack hay, can also stack bark. But it may be proper to warn him against building his stack too large, and to caution him to thatch it well."

It is suggested, that "the method of barking and treating the birch, is much the same as the oak, with this difference, that the season is winter, or early in spring; and, that it is more tedious, by reason that the outward shreddy bark of the birch is peeled off, and rejected." Of course, it follows, that if the wood "is composed of birch and oak, and if the birch is to be barked, the best method is to time the work, so as that the birches may be cut, barked, and finished by the first of May; proceeding then with the oak."

The method of drying bark in Yorkshire, according to Mr. Marshall, is generally the common one of setting it in a leaning posture, against poles lying horizontally, on forked stakes. But in a wet season, or when the ground is naturally moist, it is laid across a line of top-wood, formed into a kind of banklet, raising the bark about a foot from the ground. By this practice no part of the bark is suffered to touch the ground; and it is, perhaps, upon the whole, the best practice in all seasons and situations. It is then put in stacks or houses, and generally shaved or chopped ready for the tan-pit, and afterwards sold to the tanner at so much the quarter. This custom, however, appears to be founded on a false basis: the tanner is the best judge of the mode of preparation, and the operation ought to pass under his eye.

And the same writer remarks, that in the midland districts, it is disposed of either in the lump on the tree, or in the common way, by the ton, in the rough, the weight being ascertained by setting it up carefully against horizontal poles or tressels, and after having stood some time, till fit to carry, the buyer choosing a certain number of yards in one place, and the seller in another, which are then weighed; the rest being measured and weighed accordingly.

The practice of grinding bark does not seem to have yet got footing in the district mentioned above: whenever it does, Mr. Marshall says it will of course bring the preparation of it into its proper channel. See *Mill*.

The price of chopt bark varies according to circumstances.

BARLEY, a well-known kind of grain, from which malt is made, and of which Mr. Miller enumerates four different sorts.

1. The *spring barley*, which has a double row of beards or awns standing erect. This is the sort principally cultivated in the southern and eastern districts of both England and Scotland, and of which the farmers make two sorts, viz. the common, and the rath-ripe barley: but these two sorts are in reality the same; for the rath-ripe is only an alteration of the common barley, occasioned by being long cultivated upon warm gravelly soils. The seed of this, when sown on cold or strong land, will, the first year, ripen near a fortnight earlier than the seed taken from strong land, and therefore the farmers in the vales generally purchase their seed-barley from the warm or gravelly lands; for, when preserved in the vales two or three years, it becomes full as late in ripening as the common barley of their own product: on the other hand, the farmers on warm lands are also obliged to procure their seed-barley from the strong lands, otherwise their grain would degenerate in bulk or fullness, which, by this change, is prevented. This sort of barley is easily distinguished by the two orders of beards or awns, which stand erect; the rind is also much thinner, and therefore esteemed better for making malt.

2. The *long-eared barley*. This is likewise cultivated in many parts of England, and is a good sort; but some object to it, because, the ears being long and heavy, they think it more apt to lodge. In this sort of barley the grains are regularly ranged in a double row, lying over each other, like the tiles of a house, or the scales of fish. It has no beards or awns; and its rind is very thin, and therefore esteemed for making malt.

3. The *sprat-barley*, called also Battledore, Fulham, and Putney barley, from great quantities being cultivated in the neighbourhoods of those places. It has shorter and broader ears than either of the former sorts; the awns or beards are longer, which tend greatly to preserve it from the birds, and the grains are placed together. It seldom, however, grows so tall as the other kinds: the straw is likewise generally coarser, and therefore not so good fodder for cattle.

4. The *winter barley*, called also square-barley, bear-barley, or big, is seldom cultivated in the southern parts of England; but in the northern counties, and in Scotland, it is the general sort sown, as being much hardier than the other sorts. There are two sorts of this barley, the one with four rows of grains, and the other with six, the latter of which is commonly distinguished by the name of barley-big. The grain is large and plump; but the rind and chaff of it being thicker than that of either of the preceding sorts, it is less esteemed for making malt.

Barley, from its being that sort of grain which is considered next in value to wheat, is very generally cultivated. On dry, light, mellow soils, the thinnest rinded and largest bodied barley, which is always esteemed the best in quality, is produced. Even light poor soils, when dry, and both from nature and situation warm, yield barley superior in quality to what is commonly reaped from the strongest land when cold or wet.

Mr. Middleton, in his Report of Middlesex, observes, that the tender nature of this plant, in its infant state, unfits it for cold and compact soils. It thrives best in a soil that is moderately dry and light, as a loamy sand, and is esteemed rather a clean crop. As for this crop, the soil is generally well tilled late in the spring, which reduces the weeds very much; and as it occupies the ground only four months, they have not time to recover themselves, and perfect their seed.

Barley may and frequently is, he says, sown after every kind of crop, but always succeeds best after turnips, peas, beans, or others of an ameliorating nature.

It has been observed by Mr. A. Young, that about the end of February, part of the turnip-land may be ready for being tilled for barley. In Suffolk, a system has, for some time, he says, prevailed, of put-

ting it in on turnip-lands, by means of drilling, without any ploughing.

"For this purpose, continues he, and for many others, the surface of the field is thrown on to lands of such breadth, as shall very exactly suit for one stroke or going of the drill-machine, or for two; a *bout*, as it is termed. The shafts of the drill are fixed like those of a cart for one horse, that quarters. The horse-hoeing implements, and scarifiers, and scuffers, whatever may be used, must be prepared according to the drill-machine, to fit the lands or *stitches* exactly. We shall, says he, suppose the turnips to have been drilled, or sown, on stitches sixty-six inches wide, which will admit seven rows of barley to be drilled, at nine inches asunder, besides leaving twelve inches for each furrow. These lands being cleared of turnips, either by sheep-feeding, if the soil be dry, or by carting off with double-breast carts (the horses and wheels moving only in the furrows), and the soil on the surface being pulverized and opened in some degree by frosts, the question will be, how to prepare it for barley or oats. The husbandry universal in the kingdom, till very lately, was, he says, that of ploughing such land once, twice, or thrice, for spring corn; the better farmers thrice, others once, and a few twice. Upon very dry soils, the evil was little more than that of a useless expense, except, probably, a greater dissipation of the volatile particles of the urine of the sheep that had fed on the turnips; but upon all other soils more stiff and unmanageable, the surface which had been rendered friable by the frosts, being turned down, and the more stiff and *clung* bottom not influenced in the same manner by those natural agents being brought up; it might also, if very favourable weather ensued, be brought into good order; but if the season proved the least unfavourable, the farmer could have no chance of obtaining so fine and safe a tilth as the surface was capable of, without any such reversal of it by ploughing." Accordingly, "the new system is, he says, to apply the scarifiers instead of such ploughing. Mr. Cook's, with his cast-iron beam, or any other heavy enough, is used, the horses walking only in the furrows, and consequently without any trampling of the land. These scarifiers are of different breadths, but all narrow, usually about three inches, or, at most, four, and they will go as deeply as may be thought proper. They ought, he thinks, to stir to the depth to which it would have been ploughed, whether four, five, or six inches. They completely loosen the soil, let down the air, to dry it at bottom, give a very good tilth, with the material advantage of not burying that pulverized surface which frosts have given, and which, if once lost, may not be regained in time for barley. In some cases, one scarifying, and two or three harrowings will, he observes, effect the preparation; in others, two. Three operations may be wanted in others, that is, two scarifyings and one scuffling, with broader triangular shares. These variations will depend entirely on the degree in which the soil is tenacious, and to ascertain which, the farmer's eye and foot can alone enable him to judge. These operations go off very quickly, and leave the lands or stitches in excellent order for the drill-machine to follow, and deposit the barley-seed; the farmer, during the whole of these operations, being as little liable to be thrown out by unfavourable weather, as it is possible he should be, and much less so, than if he had ploughed the land. Those, says Mr. Young, who are used to attend to the effects of tillage on different soils, know well, that loams and clays of various degrees of tenacity, if they have been properly formed into lands for winter, and not poached by horses trampling, receive the frosts to advantage, and are found with a friable surface in the spring. If rain comes, it dries, and leaves the surface still in good order, and ready for any operation; but plough such land, and turn up the more adhesive bottom, not acted upon by frost, and let rain fall on such fresh turned furrows; it remains stiff and saddened; it does not become porous again; the air cannot get into it; and if drying sharp winds at north-east follow, the furrows become longitudinal slices of clod, very difficult to be acted upon by any instrument, and the farmer finds himself in a most unpleasant situation. He no more recovers a fine friable furface, and it becomes twenty to one whether he has a good crop. His only chance is, to have abundance of patience, to wait for favourable weather, and lay his account to sow very late." The reason for this advice of avoiding spring-ploughings, is, he says, not drawn from the practice of a few farmers, but from those of an extensive well-cultivated district.

And it is further stated by the same intelligent writer, that these "directions are not confined to the drill-husbandry, but are applicable to the preparation of the land for broad-casting." But in this last method, similar attention must be given to the breadth of the lands, as the operations must be effected by horses walking only in the furrows; and when the seed is covered by harrowing, the same regard must be paid to that circumstance.

It is the common practice in some well-cultivated heavy land districts, as Essex, to sow barley on a summer fallow. Mr. Young remarks, that there the farmers plough their fallows in August or September, on two-bout ridges, of three feet breadth; if in August, some reverse the ridges immediately after wheat-sowing, others before it. They water-grip the field well, and in February plough and sow, still on the same ridge, but harrowed nearly flat, by harrows made for the purpose. If they have a dry season to plough and sow, they get good crops, but much constantly depends on this in spring tillage." There the above practice would, he supposes, be highly advantageous.

Where barley crops could not be sown in March, they should be put into the ground by the middle of April without fail. Where the land lies as thrown up in the previous autumn, it is sown on the spring earth; as, if there had been previous ploughings in March, or in the end of February, the seed should have been put in at that period, excepting, however, such turnip-land as broke up at first too rough to be sown, which sometimes happens. Mr. Young remarks, that "the farmers in some parts of the kingdom, will put off their sowing till the last week in April, and the first or second of May, for the sake of gaining time for giving three spring

earths; but they lose, he thinks, more by far from late sowing, than they gain by making their land fine. If clover is a principal object, and they had not the land fine enough before, delays must be made; but if so, that can, he says, scarcely be owing to any thing but bad husbandry: for such events should be had in view, and the tillage given before winter, on lands not cropped with plants that stand till the spring. The utmost exertions of good husbandry should be made to reconcile jarring circumstances, when they cannot be totally prevented or avoided."

But, continues he, "in the modern system of avoiding spring ploughings, with a care proportioned to the heaviness of the soil, the main reliance is on frosts for pulverization, and the object is to keep the surface so gained, for the seed to be deposited in it." Where "the weather was unfavourable for sowing in March, or, being favourable, the breadth was too great to allow the operation to be finished, and if weeds appeared in the lands laid up for barley, it is to be supposed that they were of course destroyed by the scufflers; and that now (April) the sowing must be finished, whether broad-cast or by drilling. In the latter case, the directions relative to the right breadth of the stitches should, he says, have been very attentively executed." And it should be carefully kept in memory, "that as the summer approaches, with hot suns at intervals, any degree of poaching, or daubing, or trampling, becomes more and more fatal, for the sun binds whatever earth was touched in too wet a state. This caution has little to do with the occupiers of sand, much of which wants adhesion to be given it by art; but here, again, if such land has been amply clayed, it will sometimes be apt to set, to bind with heavy rains, so that the temper of it should always be examined before the teams at this season are permitted to work upon it."

It is obvious, therefore, that much nice attention is requisite in the business of preparing for this crop, as well as that of putting it into the earth.

In the general preparation for this sort of grain, others advise that the soil should invariably be well pulverized, and rendered open by a thin ploughing, and then by harrowing; which should be followed, at as great a distance as the season will allow, by a more deep cross-ploughing, harrowing, and rolling. And that the seed should then be ploughed in with a very small furrow, and immediately afterwards clover-seed harrowed in with short-tined harrows, which leaves the land as light as possible. The next thing to be done is, with one horse to draw a very light roll over the land, in order to press the mould gently on the seeds. These operations, they suppose, promote a more certain, speedy, and equal vegetation, than can be procured by harrowing in the seed. Harrowing in the seed is, however, the more usual method, and is, Mr. Middleton thinks, the cause of much grain being lost, and also of the crop being of two or three growths. Many farmers postpone the last rolling until the first leaves of the seeds are up, but, it is believed, more from the hurry of the season than from choice. This perfect tillage seldom fails to secure a good crop of barley, and a plant of clover.

In case of land-springs, or excessive rain, it is advisable, he says, not to plough the land flat, but into ridgelets of about eighteen inches wide. These will drain themselves dry in any weather, at least so much so, that two or three dry days will prepare the soil for harrowing previous to the second ploughing; and, if the season should still continue unfavourable, the land, on such second ploughing, might be laid up in a similar manner till sowing-time; when two or three days more of fine weather would render it fit to be harrowed or scuffled down, and for ploughing in the seed; otherwise a third ploughing may be given, and the seed harrowed in; which last is esteemed the better practice, when the soil is not quite so dry as could be wished. Scuffling the land, instead of the second ploughing, would, in every fine season, dispatch the work, and be a saving of expense. Scuffling the cleanest soil would be equal to cross-ploughing; and, in soils not quite free from root-weeds, it would be much better, by bringing them within reach of the harrows. It will perform upwards of double the quantity of work with the same number of men and horses, and leave the land equally ready for the harrow and roll previous to the sowing.

Mr. Bannister, however, in his Synopsis of Husbandry, observes, that it is improper to sow clover among barley on rich land, because the natural fertility of the soil hastens on the vegetation of the grass, which will, before harvest, have advanced to a considerable height among the corn, and will occasion a longer time to be necessary for drying the swarth; and thus, by lying abroad longer than would otherwise have been required, a total destruction of the crop may ensue: but on thin lands, where there is not the danger of so luxuriant an increase, clover, trefoil, and other grass-seeds may, he thinks, often be sown among barley; and, if a favourable time can be procured for harvesting it, the straw may be greatly improved by the mixture of the clover or other grasses, and become then a valuable fodder in the winter; but barley-straw simply is, he says, the most ordinary food of any.

Where barley succeeds turnips, the land is sometimes only once ploughed; but Mr. Donaldson says, that a much better method is to plough it twice; first, early in spring, and again before sowing the seed. This last is the practice in Norfolk, where that species of grain is cultivated in a more perfect manner, and to a greater extent, after turnips, than, perhaps, in any other district. But when barley is sown after peas or beans, or oats, the land is commonly first ploughed in autumn; and the attentive farmer always takes care, on this occasion, to plough in such a manner as to expose as great an extent of surface to the influence of the air and frost as possible; and, at the same time, to form the ridges in such a way as to prevent the field from receiving any damage from excessive rains during the winter. The second ploughing is given immediately after the oat-seeding is finished. This ploughing is intended to answer two purposes. In the first place to loosen the couch-grass and other root-weeds, so that they may be easily taken out by the harrows, which are immediately afterwards applied; and, in the second place, to reduce the soil to a finer tilth, whereby the seed-weeds are encouraged to vegetate,

and which the subsequent ploughing and harrowing, at seed-time, effectually destroy.

Barley is also frequently sown after wheat, when the same mode of culture as just mentioned is adopted. But however common this rotation of cropping may be in some districts, there is no good reason, he says, why it should be recommended to the general notice of farmers. For two white-corn crops succeeding each other, is undoubtedly an erroneous method, both for profit and improvement. Besides, it mostly happens, that where barley succeeds wheat, the crop is in some measure blighted, many of the stalks becoming white about the month of July; and where there are any grains in the ears, they are shrivelled, and never come to maturity, though the soil may be well suited to the production of this sort of grain.

Mr. Middleton, indeed, thinks, from the nature of corn-crops, that it ought not, on any account, to be sown after either wheat, rye, or oats; a much better practice being, to sow it after turnips, potatoes, carrots, tares, &c. and, in some cases, after hemp, flax, and rape. The land should not receive any further manure than what was laid on for the preceding crop, together with the dung and urine deposited by cattle during the time they are eating the green crop off.

The barley-seed season commences in most of the southern counties about the first week of March, and terminates, in the more northern ones, towards the middle of June. But from the middle of March to the end of April may be reckoned the chief barley-seed season, as within these periods by much the greatest proportion of that species of grain is sown.

The author of the Report of Middlesex says, that barley, though usually sown during the months of March, April, and May, has succeeded when sown the first week in June; but it ought to be sown as early as the soil is sufficiently dry, and in condition to receive it, and the prior attention which is due to the oat, tare, and other crops, will permit. Let it always be kept in mind, says he, that barley will bear late sowing much better than those crops.

Both the four and six-rowed kinds of barley are frequently sown in the autumn, nearly at the same time with wheat, not only in temperate climates, but also in very cold countries; their hardiness being such as to bear the severity of the winter, even in the mountainous parts of the northern countries. In hot countries they are mostly sown in January, February, and March.

All the other sorts are sown in the spring of the year in a dry time, as has been already seen: when this sort of grain is sown late on strong clayey soils, if the season does not prove very favourable, it is very late before it is fit to reap or mow, unless it be the early or *rath-ripe sort*, which is often ripe in nine weeks from the time of sowing. Mr. Lisle is, however, of opinion, that this in particular ought to be sown early, for otherwise it will grow very thin. He likewise thinks that it should be sown on better ground than the other barley, because, as it ripens in a shorter time, it may be naturally supposed to exhaust the nutritive principles of the earth faster than other corn. But it is said by others, that these nutritive materials, in almost any tolerable soil, will probably hold out long enough to feed a crop of so short standing as this, though they might not be sufficient for corn, which should remain longer upon the ground; and it is added, that about Patney, in Wiltshire, they sow the poorest sandy ground with *rath-ripe barley*

Mr. Lisle adds, that he himself, many years ago, sowed, in Hampshire, *rath-ripe barley*, in very poor light ground, and some of the same kind of grain in good strong clay-land. No rain fell to bring it up till June: after which there were frequent showers, and plenty of rain till harvest. His *rath-ripe barley*, in the poor land, was miserably bent, broken in the straw, and harted, or fallen down. In the strong clay land it suffered the same injuries, though in a less degree: and the straw and leaves of the *rath-ripe barley*, in both places, blighted, and were full of black specks; their ears being thin, and their colour lost; while the plants of late-ripe barley, in an adjacent field, were free from these spots, and stood upright with good strength. From this experiment he infers, that since the clay land in the hilly country of Hampshire, though in good heart, cannot, even in a moist year, sufficiently feed the straw of rath-ripe barley, so as to enable it to stand upright, but suffers it to be languid and withering, this sort of corn is not proper for such places, and that it is better to sow late-ripe barley, even though three or four horses extraordinary be provided against sowing-time, in order to get the corn into the ground a week before May begins.

The common spring-barley bears late sowing, even upon ground not much exposed to the sun, Mr. Lisle observes, better than the *rath-ripe* sort; but not near so well as the late-ripe, or common long-eared barley; nor will its stalk stand so long. He was also convinced from experience, that late-ripe barley endures being sown when the ground is wetter than the rath-ripe sort.

The quantity of seed-barley allowed to the acre varies very much; and depends not only on the quality of the land and the season, but on what was the preceding crop, and also on the condition of the land at the time of sowing. When barley succeeds turnips, the land being then in the best possible condition for receiving the seed, a less quantity is necessary than if it were to be sown after two or three successive white-corn crops. The usual allowance to the acre is from three bushels and a half to five; but four bushels and a peck may be considered as the general average: so large a quantity as five bushels being never sown, but on lands exhausted and worn out with over-cropping.

Mr. Middleton also remarks, that early sowing requires less seed than late; but on a medium soil, in proper condition, sown broad-cast, in March three and a half, in April four, and in May four and a half bushels per acre. A rich soil makes such great difference, that it can hardly be sown too thin; even one bushel and a half, early sown, have produced as much as could stand; whereas, had three or four bushels been sown, the crop would have been lodged, and of a very reduced value.

Mr. A. Young thinks, that "the quantity of seed-barley should be increased as the season advances. Early corn-crops have more time to tiller than late

sown ones. If three bushels be the quantity in February, three and an half should be given in March."

Mr. Donaldson observes, that if a statement of the average-returns of barley by the acre was confined to England and the south of Scotland, it might be rated at thirty-two bushels; but when Wales and the north of Scotland are included, where, owing to the imperfect modes of culture still practised, the crops are very indifferent, the general average over the whole will not probably exceed twenty-eight bushels the acre.

Mr. Middleton states it as varying in England from fifteen to seventy-five bushels per acre. The average produce of the county of Middlesex, he says, is about four quarters of corn and two loads of straw per acre. The straw usually sells at about one guinea a load, delivered in, which, with chaff and thin grain, is equal to one shilling and sixpence per bushel on the corn; and, as the corn has averaged three shillings, together they produce four shillings and six-pence per bushel, or seven pounds four shillings per acre.

The ultimate destination of barley to be converted into beer and spirits, he says, raises the value of this crop to more money per acre than that of any other grain. For, after the farmer has disposed of it, the malster, brewer, distiller, rectifier, and victualler, successively draw the wages of labour and profit from it, before it comes to the consumer. Including a revenue of five millions and one quarter a year, which it nets to government, but which costs the subject between six and seven millions, its entire expense to the consumer, at this time, is not less than thirty pounds an acre. He understands that porter is brewed in the ratio of 162 gallons from one quarter of malt; and is sold by the retailer after the rate of one shilling and two-pence per gallon, which produces nine pounds nine shillings. Deduct the value of the hops, and there remains upwards of a guinea a bushel for the malt, or full thirty pounds an acre. In the article of spirits, he thinks, it must necessarily yield much more.

Mr. Donaldson says, that barley is applied to various uses. In Wales, Westmorland, Cumberland, and in the north, as well as in several parts of the west of Scotland, the bread used by the great body of the inhabitants is made chiefly from barley. Large quantities of the barley cultivated in England are converted into beer, ale, porter, and what is called British spirits, as English gin, English brandy, &c. The remainder, beyond what is necessary for seed, is made into meal, and partly consumed in bread by the inhabitants of the above-mentioned districts, and partly employed for the purpose of fattening black-cattle, hogs, and poultry. There is a much greater share of the Scotch barley consumed in distillation, in proportion to the quantity cultivated, than there is in England. Exclusive of what is used for seed, the Scotch barley is either converted into beer or ale; or made into pot-barley, or into meal, for the use of the inhabitants in the more remote and less cultivated parts of the kingdom; or, lastly, into whiskey.

In the Report of Middlesex it is stated, that much of the most ordinary barley is given to poultry; the rest is sold to the malsters, except so much as is reserved for seed.

In respect to pearl-barley it is observed, that a mill to manufacture it costs about twenty pounds. A ton, or 160 stone, of pearl-barley sells for twenty-three pounds, which is rather under three shillings a stone, or thirteen shillings and four-pence a bushel. Twenty-three stone and a half of common barley produces five stone and a half of pearl-barley, by the common method of manufacturing it; but by an addition to the mill, which would only cost two pounds, the barley-corn could be split, and then the same quantity would yield nine stone of pearl-barley. This is stated on the authority of evidence before a committee of the London Society of Arts, &c. See *Mill*.

With regard to the choice of seed-barley, it is necessary to observe, that the best grain for sowing is that which is free from blackness at the tail, and is of a pale lively yellow colour, intermixed with a bright whitish cast; and if the rind be a little shrivelled, it is so much the better, as it shows that it has sweated in the mow, and is a sure indication that its coat is thin. The husk of thick rinded barley being too stiff to shrink, will lie smooth and hollow, even when the inside flour has shrunk from it. The necessity of a change of seed from time to time, by sowing that of the growth of a different soil, as has been observed, is in no instance more evident than in the culture of this grain, which otherwise becomes coarser and coarser every year. But in this, as well as in all other grain, the utmost care should be taken that the seed be full bodied.

It is easy to suppose that, in some cases, barley, like wheat, may be benefited by being steeped before it is sown. For as rain cannot always be depended upon soon after the sowing of spring corn, there is surely an equal reason for extending the practice to these sorts of grain, as well as those which are sown in autumn. Liming, indeed, may hurt barley in some cases; but a little sprinkling of soot bids fair for improving it, at least it may prevent insects from preying upon the seed.

Mr. Middleton remarks, that the seed is never steeped, and yet the farmers are continually complaining of its coming up at different periods: thus producing two crops, which do not become ripe at the same time, and are injurious to the sample. Steeping the seed a proper number of hours, which might be ascertained by experiment, seems, he says, to be as well calculated to secure a uniform vegetation, and prevent this complaint, as poisoning the seed appears to be to keep it from vermin.

It was stated by Mr. Miller, that the common method was, formerly, to sow the barley-seed with a broadcast at two sowings; the first being harrowed in once, but the second not until the seed is buried; the common allowance of seed was four bushels to an acre: but, says he, if the farmers could be prevailed upon to alter this practice, they would soon find their account in it; for, if a third part of that quantity be sown, there will be a much greater produce, and the corn will be much less liable to lodge, as he has many times experieneed; for, when corn or any other vegetables stand very close, the stalks are drawn up

weak, and thence incapable of resisting the force of the winds, or supporting themselves under heavy rains: but when they are at a proper distance, their stalks will be more than twice the size of the others, and therefore are seldom laid. He says, he has frequently observed, in fields where there has been a foot-path through their middle, that the corn, which has stood thin on each side of the path, has stood upright, when all the rest on both sides has been laid flat on the ground; and whoever will give himself the trouble to examine these roots near the path, will find them tiller out, that is, have a greater number of stalks, to more than four times the quantity of the other parts of the field. He has seen experiments made by sowing barley in rows across divers parts of the same field, and the grains sown thin in the rows, so that the roots were three or four inches asunder in the rows, and the rows a foot distant; the intermediate spaces of the same field were, at the same time, sown broad-cast in the usual way. The success was this: the roots which stood thin in the rows tillered out from ten or twelve, to upwards of thirty stalks on each root, the stalks were stronger, the ears longer, and the grains larger than any of those sown in the common way; and when those parts of the field where the corn was sown in the usual way have been lodged, these parts sown thin have supported their upright position against wind and rain, though the rows have been made not only lengthways, but across the lands, in several positions; so that there could be no alteration in regard to the goodness of the land, or the situation of the corn. Where, therefore, such experiments have been made, and always attended with equal success, there can be no room to doubt which of the two methods is more eligible, since, if the crops were only supposed to be equal in both, the saving two-thirds of the corn sown is a very great advantage, and deserves a national consideration; as such a saving, in scarce times, might be of very great benefit to the public. This saving of seed-corn, says he, must be understood to regard such as is sown broad-cast; for if it be sown in drills, an eighth part of the seed usually sown will be sufficient for an acre of land, and the produce will be greater; for all sorts of corn are naturally inclined to send out several stalks from each root, which they rarely fail to do where the roots are at a proper distance, and have room: nor do the stalks grow, in this case, near so tall, but are much stronger than when they are near together, when they rarely have more than two or three stalks; whereas, those roots which have proper room seldom have less than ten or twelve. He has had eighty stalks upon one root of barley, which were strong, produced long ears, and the grain was better filled than any he ever saw grow in the common method of husbandry, and the land on which this grew, was not very rich; but he has frequently observed on the sides of hot-beds in the kitchen-gardens, where barley-straw has been used for covering the beds, that some of the grains left in the ears have dropped out and grown, the roots have produced from thirty to sixty stalks each, and those have been four or five times larger than the stalks ever arrive at in the common way. But to this he knows it may be objected, that although upon rich ground in a garden these roots of corn may probably have so many stalks, yet in poor land they will not have such produce; therefore, unless a greater quantity of seeds be sown, the crop will not be worth standing: which is, he says, one of the greatest fallacies that can be imagined; for, to suppose that poor land can nourish more than twice the number of roots in the same space as rich land, would be such an absurdity as one could hardly suppose any person of common understanding guilty of; and yet so it is: for the general practice is to allow a greater quantity of seed to poor land than for richer ground, not considering that where the roots stand so close, they will deprive each other of their nourishment, and consequently starve themselves, as is always the case when the roots stand close, which any person may at first sight observe in any part of the field where the corn happens to scatter when they are sowing it; or in places where, by harrowing, the seed is drawn in heaps, those patches will starve, and never grow to a third part of the size as the other parts of the same field; and yet, common as this is, it is little noticed by farmers, otherwise, says he, they surely would not continue their old custom of sowing. He has made many experiments for several years in the poorest land, and has always found that all crops, which were sown or planted at a greater distance than usual, have succeeded best upon such land; and he is convinced, if farmers could be prevailed upon to quit their prejudices, and make trial of the method of sowing their corn thin, they would soon see the advantage of this husbandry.

The experiments of Mr. Young, however, lead us to a different conclusion. On April 25, 1791, upon a land of moist loam on a wet marl bottom, worth about 16*s*. an acre, he marked four beds, each eight feet long by three feet broad, and dibbled them with four-rowed barley.

No. 1, 91 holes, and four seeds in each hole.
2, 198 ditto, three seeds in each.
3, 198 ditto, one seed in each.
4, 198 ditto, two seeds in each.

No hoeing given; but before they ripened a net was suspended over the whole, to guard the barley from the ravages of birds.

On Sept. 9th he reaped them, and, clipping off the ears, weighed them.

No. 1, $28\frac{1}{2}$ ounces.
2, 31.
3, $20\frac{3}{4}$.
4, 24.

In No. 1, 13 grains of seed give one ounce produce.
2, 19 grains of seed one ounce produce.
3, $9\frac{1}{2}$ ditto ditto.
4, $16\frac{1}{2}$ ditto ditto.

In No. 1, 15 grains of seed per square foot.
2, 24 ditto ditto.
3, 8 ditto ditto.
4, 16 ditto.

It seems, says he, remarkable, that comparing No.

1 and 4, the seed are nearly the same, yet the crop is different, and very considerably in favour of the seed being crowded together in clusters, rather than spread much more equally over the ground. This, continues he, is a most singular circumstance. It coincides very much with the modern practice of dibbling wheat, which has been changed gradually from one grain in a hole to two, three, and even four, and this cluster-sowing has been found to answer best. But upon what principles? And owing to what cause? Theory would seem to tell us, that plants standing single would have regular spaces for the roots to feed in, without struggling with each other for nourishment: but there must be some other circumstance which more than balances this advantage. The farmers say that the plants assist each other; but how? Is it by shelter? Is it by an accelerated fermentative motion from additional warmth? Very obscure all this; but highly deserving further repeated and varied experiments. Mere quantity of seed appears to have much effect, for No. 2, the most seed, has of all the greatest crop.

It is a common practice, in some parts, to scatter the dung of pigeons, poultry, &c. over barley and other grain, after they are sown; but if this method be pursued, care should be taken to scatter the dung immediately; because then the shoot will easily make its way through: but when laid on later, it is apt to burn up and destroy the blades of the young plants.

It often happens, from unfavourable weather, and an extremely dry spring, that it is impossible, by the common method, to break the clods, and prepare the ground sufficiently for sowing barley; in which case it has been the usual method to break the clods with a large beetle, called, from its use, a clotting-beetle. But this being a very expensive and tedious method of preparing land, induced the ingenious Mr. Randall, of York, to construct an instrument, which he calls a spiky roller, by the assistance of which a large quantity of land may, in such a dry season, be soon reduced to an exceeding fine tilth, with very little trouble. See *Roller*.

After the barley is sown and harrowed-in, the ground should be rolled after the first shower of rain, to break the clods and lay the earth smooth; which will render it easier to mow the barley, and also cause the earth to lie closer to the roots of the corn, which may be of great service to it in dry weather. And also when the barley has been up three weeks or a month, it may be a good method sometimes to roll it over with a weighty roller, which will again press the earth close to the roots of the corn, and thereby prevent the sun and air from penetrating the ground in dry seasons; and this rolling of it before it stalks, may likewise cause it to tiller out into a greater number of stalks; so that, if the plants should be thin, it may cause them to spread so as to fill the ground, and likewise strengthen the stalks.

Such barley-crops as have been drilled in at such distances as are sufficiently wide for admitting the horse-hoe, should be well attended to and cleared of weeds in the early part of May; the rows being cleared with the hand, where it may be found necessary.

And, in the broad-casted crops, the same attention should be bestowed by means of proper hand-hoeing and weeding, as where this is neglected much injury must often be sustained by the farmer; from the overpowering of weeds in the early growth of such crops.

If the corn should grow too rank, as is sometimes the case in a wet spring, mowing is then much better than feeding it; because the scythe takes off only the rank tops, but the sheep feed upon all indifferently; nor should they even, in any case, be left upon it too long, because, being particularly fond of the sweet end of the stalk next the root, they bite so close as to injure the future growth of the plant.

Barley is ripe when the red roan, as the farmers term it, meaning a reddish colour on the ear, is gone off, or when the ears droop, and fall as it were double against the straw, and the stalks have lost their verdure. If it be full of weeds, it must lie in the swarth till they are dry. It is not apt to shed; but in wet weather it will be apt to sprout or grow musty; and therefore every fair day after rain it should be shook up and turned; and when it is tolerably dry, let it be made up into shocks; but be careful never to house it till thoroughly dry, lest it mow-burn, which will make it malt worse than if it had spired in the field. The common produce of barley is two or three quarters upon an acre.

It is remarked by Mr. Lisle, that poor thin barley should be cut a little sooner than if the same plants were strong and vigorous; as the straw, when the plants are full ripe, in such cases will not stand against the scythe. In this situation, barley in particular should lie in swarth till it is thoroughly dry. Some of his barley, which lay out in swarth five or six days in very fine weather, though both blighted and edge-grown, grew plump, and acquired very near as good a colour as the best. He reckons short scythes the best for mowing lodged or crumpled corn, because they miss the fewest plants; and observes, that a bow upon the scythe, which carries away the swarth before it, is preferable to a cradle, the fingers of which would be pulled to pieces by the intangled corn, in drawing back the scythe.

In the seventh volume of the Annals of Agriculture, Mr. Young gives the following experiments, by Mr. Macro, on early and late sowing of barley: On Nov. 16, 1785, he began this experiment by sowing two bushels of barley, which he harrowed-in, on clover-land that had been folded the same as for wheat; this first sowing, therefore, had only one earth. The barley came up about a week sooner than the wheat, by the side of it, which was sown the same day, and was exceedingly flourishing till the first sharp frost set in, which damaged the blade, but did not seem to affect the root. As near the middle of December as the weather would permit, he sowed two bushels more, on exactly the same quantity of ground, and so on about the middle of every month, till the month of May, 1786. This, and every sowing after it, had two earths; one cast, or half the seed, was ploughed-in, and the other half harrowed-in; all the land was folded alike in the month of November. The second sharp frost killed some of this sowing, and a good deal of that sown in November; but they

both, with that sown in January, seemed to suffer still more by the sharp cutting winds in the month of March, when there was no snow to cover the blade, and it was injured by the frost. The sowings in February and March lost few, if any, of their plants, and, what was somewhat remarkable, were both forward enough to be harvested on the same day with the three preceding sowings. That sown in April was full a fortnight later; and that sown in May, there not being any so late sown in the neighbourhood, was entirely destroyed by vermin.

As he some years before intended trying the same experiment, but was disappointed of knowing the event by the stupidity of his workmen, he determined this time to prevent any mistakes by mixing the different parcels in the barn, to thresh enough of the different sowings in the field to satisfy himself which was the most profitable crop, and accordingly attended the thresher the whole day himself.

As it was not at all necessary for the experiment to thresh the whole crop, he took three swarths of each sowing, twelve yards in length, on the lowest part of the land, where he thought the soil was the most equal for the purpose of the experiment, which, he should have observed before, were by the side of each other, on the same piece of land. He had every parcel dressed and put into a sack by itself as soon as threshed, and the account stood thus:

	Pecks.	Qrs. P.	Pints.		Coombs.	Bushels.	Pecks.	Quarts.
From that sown in November 72 sq. yds.	3	—	—		12	2	1	—
December -	3	—	1	or per acre.	12	3	$1\frac{3}{4}$	$1\frac{1}{2}$
January -	3	1	—		13	—		—
February -	2	3	2		11	2	$2\frac{1}{4}$	—
March -	2	2	2		10	3	$3\frac{3}{4}$	1
April - -	2	—	2		8	3	$2\frac{1}{4}$	1
May - -	0	0	0		0	0	0	0

This last sowing, as observed above, was entirely destroyed by the rooks; he believes it had not been sown more than three days before they began to scrape and pick it up, and completely devoured it. It was the same with the very early sowings, but that he expected, and was guarded against. It may, however, serve as a lesson to young farmers, that although early sowing may in most cases be profitable, yet it will not answer in large open fields, where lands are intermixed, unless neighbours sow at the same time; for, if only one farmer sows early, he had need have as many keepers as he has pieces of land. The barley of all the sowings was of the Zealand stock. On the same piece of land on which he tried the above experiments, which was a deep sand, value about six or seven shillings per acre, he tried two others, one about ten years since, with chalk from different pits, some of which was a dry chalk, and others greasy: he carried only one load of each sort, and laid it about the thickness of seventy loads to an acre. Neither of them did the least good, for he could not tell by any of the crops since, without looking at the soil, where they were laid. The other was by deep ploughing, in the autumn of 1785, when he sowed part of the piece with wheat, by going with a second plough after the first, for one steatch only, and raising about three or four inches of soil that had never been turned up before; on viewing it about midsummer, he could not find where it was, by any apparent difference in the crop, nor could he see that the barley sown in January was the best crop. By the same rule, when he began to try the experiment before, that sown in February was the best, and it appeared so on view, he remembers, all the summer.

Mr. Middleton says, that in Middlesex, the barley-harvest commences about the middle of August, and generally after the oats and wheat are reaped. It is nearly all mown with scythes, previously furnished with bows or cradles, to collect the corn together, and keep it from scattering. Some of the heaviest crops are then bound into sheaves, and set up in shocks; but in general it lies in the swarths till it is in a proper state to be carried. It is then raked into heaps, in rows, placed at such a moderate distance from each other, that, when the cart goes between two rows, a man on each side may pitch to the load without over-reaching. It is then carted home, and put into stacks, or barns, in the same manner as hay. Barley is less in danger of shaking out of the ear, from being too ripe, than any other kind of grain; which is one reason for its being the last reaped. An ear of common barley is seen at *fig. 9. pl. III.*

BARLEY-*Grass*, a course sort of grass, of little use to the farmer. See *Hordeum*.

BARLEY *Mill*, a mill for the purpose of preparing barley for various domestic uses. See *Mill*.

BARM, the foam or froth of beer, or any other liquor in the state of fermentation. It is used as a leaven or ferment in the making of bread, &c. See *Yeast*.

BARN, a covered building, constructed for the purpose of laying up all sorts of grain, hay, straw, &c.

Farms should always be furnished with barns proportioned to the quantity of grain they produce; but, since the practices of stacking hay and grain, and threshing by mills, have become more general, there seems to be much less need of large barns. They should have a dry situation, and be placed on the north or north-east side of the farm-yard, but not, by any means, contiguous to the house.

Barns may either be constructed on wooden frames covered with planks of oak, or be built of brick or stone, whichever the country affords in the greatest plenty; and in either case there should be such vent-holes, or openings in their sides or walls, as to afford free admittance to the air, in order to prevent the mouldiness that would otherwise, from the least dampness, lodge in the grain. The gable-ends are probably best of brick or stone, on account of greater solidity; the whole may be roofed with either thatch or tiles, as can be most conveniently procured. They should have two large folding-doors facing each other, one in each side of the building, for the convenience of carrying in or out a waggon-load of corn in sheaves; and these doors should be of the same

breadth with the threshing-floor, to afford the more light and air; the former for the threshers, and the latter for winnowing. Over the threshing-floor, and a little above the reach of the flail, poles are often laid across from one beam to another, to form a kind of upper-floor, upon which the thresher may throw the straw or haulm, to make an immediate clearing, till he has time to stow it properly elsewhere: and on the outside, over the great doors, it is sometimes convenient to have a large pent-house, made to project sufficiently to cover a load of corn or hay, in case a sudden storm should come on before it can be housed; and also to shelter the poultry in the farm-yard in great heat or bad weather.

It was formerly the custom in countries that abounded in corn to have separate barns for wheat, for spring-corn, such as barley and oats, and for peas, tares, lintels, clover, sainfoin, &c. but where the grain can be stacked, the heavy expense of so many buildings of this kind may be avoided.

Some art, which must be the result of practice, is necessary in placing and piling up the sheaves in barns. But it may not be useless to observe, that it is always necessary to press them as close to the walls of the barn as possible, so as not to afford the least room for rats or other vermin to creep in between them: for if they once get admittance, they will soon penetrate further, lodge themselves in the mow, and do prodigious damage to the corn. Where this misfortune happens, the only remedy is to take down the mow, destroy the vermin, and pile it up anew.

A correspondent of Mr. Young's, in the sixteenth volume of the Annals of Agriculture, in speaking of the construction of barns, says, that the underpining should be of brick or stone, two feet high above ground, and the sides boarded: the roof of the barn will be best covered with reed or straw, and those of the stables with slate or glazed tile; because they must be more flat, and the water which runs from the roof of the barn would injure most other coverings. At each end of the barn, and over the back-door, small doors four feet square should be fixed at the height of twelve feet from the ground; the two former for putting corn in at the ends, and the latter for filling the middle of the barn after the bays are full. All the bays should have a floor of clay or marl, and the threshing-floor be made with hard bricks, which will be sufficient for all sorts of grain, except wheat and rye; and for threshing them it will be good œconomy to have planks of oak or red deal, well fitted together and numbered, to be laid down occasionally, and confined by a frame at their ends. A barn built on such a plan would hold a great deal of corn, and be filled most conveniently: and if stacks of corn were built at each end, they might be taken in without any carting. If more buildings are requisite, two may be added on the backside like the stables in front; otherwise, if doors are made under the eaves on the backside, as directed at the ends, and stacks be placed opposite to them just far enough to avoid the eaves' dropping, by placing a waggon between them and the barn by way of a stage, those stacks may be taken in without carting; which method spares a great waste of corn, and much trouble. The spars of the roofs of the stables rest upon the upper sills of the sides of the barn, and the outside wall of the stable is eight feet high; the barn supplying the highest side and one end of each stable: and the stables in return are buttresses to the barn, and strengthen it greatly.

He farther observes, that to arrange buildings of this nature conveniently, is of prodigious importance to cattle, sheep, and hogs; and also to saving expenses in labour, and in waste of hay, straw, &c.

The new invented machines for threshing alter, he says, very much the plans of barns; where they are used, they should be built in the centre, and the corn-stacks so disposed around as to supply the machine without the use of cart or horse: than which nothing is more easy to contrive. The barn in such case is a mere receptacle for straw, and should be contrived with a view to its distribution.

He has seen, he says, very expensive barns in Ireland, which the owners have boasted would confine a mouse; so much the worse: there cannot be too much air all around: the sides, for this reason, should be neither of brick nor stone, unless, which would be very difficult, the whole was a system of arches; for those imperfectly pierced with apertures of the form of a small segment of a large circle of brick tunnel-work, which he has seen let into the walls, are always far too few to do good, and the common air-holes are nothing. The best barns for corn are of boards; and the more air those boards admit, the better will the straw be for the cattle, and the brighter the sample of corn in a ticklish season. Combine this fact, says he, with that of Hendon farmers, where the best hay, perhaps in England, is made; never putting it in any sort of building, but always in stacks.

Mr. Marshall, in his Rural Œconomy of Norfolk, observes, that the barns of Norfolk are superior to those of every other county; numerous and spacious. No farm has less than three threshing-floors; some five or six, and these of unusual dimensions.

The same author, in his Rural Œconomy of the Midland Counties, remarks, that the only thing noticeable in the barn of that district is an improvement lately introduced, he believes, in the means of supporting the roof. Instead of beams and principals, partial partition-walls are raised on either side the floor and between the bays, to take the purlines; leaving an opening or large door-way, in the middle of the building, to admit the corn. In a capital barn, where two pair of purlines were necessary, the cheeks of walling were narrow, not more than five feet wide, receiving the lower purlines only, with short beams and principals, resting on the tops of the cheeks or partial partition-walls, to support the upper ones. This mode of construction is cheaper than oak-beams, takes the weight of the roof in a great measure off the side walls, and frees the body of the barn from beams, well-known nuisances in filling a barn, yet stiffens the building. On each side the floor, these partial partitions are evidently eligible, on these and various other accounts, without any evident disadvantage.

And, in the Rural Œconomy of Yorkshire, he says,

that he observed an entire farmery under one roof. One end was occupied by a small dwelling, the ground-floor of the remainder by a stable and beast-house; over which were a barn and hay-chamber, with a chamber barn-floor: a thing he had not seen, nor conceived an idea of, before he observed it, in more instances than one, in this district.

The above-mentioned is the only one he has seen in a new erection; he has, however, had full opportunity of observing the use of another thrown over a cow-house, in a large old building which had long been used as a barn, stable, and beast-house.

No essential disadvantage has yet, he observes, struck him respecting a chamber threshing-floor; but with respect to a chamber-barn, there is one which is obvious, namely, that of having the corn at harvest, a busy season, to raise one story higher than ordinary.

Another idea in rural architecture, new to him as that of a chamber threshing-floor, he says he has seen executed in a substantial manner by two of the first occupiers in the district, namely, a granary over a barn-floor. In all other barns he has seen, the space over the floor, whether this be large or small, and whether the building be low or lofty, remains entirely useless, except in one instance, in which a very spacious building having been converted into a barn, joists were thrown across out of the reach of the flail, and the mows continued over the floor. The idea of occupying the lower part of this space with a cattle-house, as well as that of filling the upper part of it with a granary, have, perhaps, been originally and recently struck out in this county.

In the two instances in which he has seen granaries over barn-floors, the joists are supported by two beams thrown across the building, and the flooring of the granary let into the walls at the ends; so that, notwithstanding the granaries may be surrounded with vermin, they are proof against them. In the floor is a trap-door with tackle over it, to raise and lower the corn from and to the barn-floor. The height between the floors, thirteen feet. This, in his opinion, is too great a height. Ten feet high is the most the flail requires; and every inch above that height renders the granary in many respects less commodious.

Confining the dust, which always rises more or less in threshing, appears to be the only objection to a barn-floor granary:—he means in a barn with pitching-holes to house the corn at. But, if ventilators were made immediately under the granary-floor, with valves to open or shut as the wind should change, the health of the thresher would in all probability be less injured than it generally is by this laborious and unhealthy employment.

Indeed, in this county, says he, where tall wide folding barn-doors are grown into disuse, vent-holes of this kind are in some degree necessary to every barn-floor. Even upon the Wolds, a corn country, the use of large doors is declining: some good barns have lately been built with common-sized doors, one at each end of the floor, opening, however, in two parts, one above the other, so that the lower half can be shut to keep out pigs and poultry, while the upper one is opened to let in light and air. This is a fortunate circumstance for the owners of landed estates: folding-doors, large enough to admit a load of corn, are expensive in the first instance, and frequently require repairs; besides the threshing-floor, be it of what material it may, is liable to great injury in the act of drawing loaded waggons upon it.

Indeed, says he, throughout, the Yorkshire barn is characterised by œconomy. In Norfolk, barns of one hundred and fifty to two hundred pounds cost are not unfrequently built: here, a very convenient one, and such a one as will satisfy a good tenant, may be built for forty or fifty pounds. What a saving is this upon a large estate!

In the Rural Œconomy of Gloucestershire, he also tells us, that in that county he likewise met with a granary over a barn-floor, the height about ten feet, just out of the reach of the flail; and with two instances of granaries over pitch-roof porches; a new idea, and a very good one. The corn is hoisted up by tackle, and shot down through canvas tunnels into bags placed below.

The size of barns in this county, he says, is above par; in height, above any he has observed. Fifty-two by twenty feet in the clear, and sixteen to twenty feet high to the plate is esteemed a good barn. This size admits of four bays of ten feet each, with a floor in the middle. There are some remains of old monastery-barns of great size in this district. The height of modern barns may have arisen from observing in those that, one foot below the beams is worth two above.

Mr. Billingsley, in the Survey of Somersetshire, observes, that the practice lately introduced, of placing the barns on a declivity, cannot be too much commended; a warm and commodious stall for oxen, covered by one roof, is thereby gained. The barn-floor, thus elevated, is rendered more durable, and less subject to vermin; the corn is kept more dry and sweet than on a ground-floor; nor can it slip through the barn-floor without discovery; and he knows of no possible inconvenience that can accompany this plan. Barns, such as these, are placed with a south-east aspect, and the arches of the stalling front that way. Annexed thereto is a capacious yard, with proper cribs for hay and straw, where the animals feed, and retire at their pleasure to their comfortable lodgings under the barn.

Mr. Beatson, in a valuable paper upon farm buildings, inserted in the first volume of Communications to the Board of Agriculture, states, that in most parts of England the size of barns, consequently the great expense laid out upon them, appears very far to exceed what is necessary for such buildings. This extent of building is, however, he says, by many thought requisite for the purpose of storing the crop in the straw; a practice so prevalent in many places, that it may not be improper to examine into the motives for doing so. The principal reasons why many English farmers are so partial to housing their corn, are said to be these:

First, because it is built at less expense in the house than in the rick-yard. Secondly, because it is

better secured, and saves the expense of thatching and of thatch. And, thirdly, because it is always at hand to be threshed.

The first of these reasons appears, says he, to be quite imaginary; for surely the care necessary to be taken to build in the barn so compactly as is generally done, in order to keep out vermin, as is supposed, and to make it hold the greater quantity, must be attended with full as much expense as building in the rick-yard, perhaps more; for, in a large barn, the distance to throw the sheaves, and the number of hands requisite to carry them to their proper places for packing close, will be attended with more expense and labour, and more loss of time, than building in the rick-yard. The second reason seems also to have little weight; for, although neatness in every thing is much to be commended, there is certainly no necessity for consuming either so much time or so much thatch in covering stacks as is done in many places. If they are thatched sufficiently to keep out rain, and secured properly to resist a blast, it is all that is requisite; but to bestow as much labour and expense on covering a stack which will probably stand but a few weeks, as in covering a permanent building, is surely most completely absurd, and totally inconsistent with that dispatch which ought to be observed in all the operations of farming, particularly in the harvest-time, when a farmer should always be in a hurry; for it ought to be a general rule with every farmer, especially at that time, never to lose a moment, but to make the most of the present hour, and on no account to delay or trust any thing to the next; but to consider, however fair the prospect may be, that the next hour, or next day, it may be so changed as to put it out of his power to proceed with his operations. On this principle, which is founded on reason and prudence, corn should be put in the stack whenever it is ready for it, which it will certainly be several days before it can be ready to put in a large barn.

No stack, he observes, should be above ten or twelve feet in diameter, but most barns are from twenty to twenty-four feet wide. Is it to be wondered at then, says he, that corn piled to such a thickness contracts a mouldiness? It would be much more extraordinary if it did not: for it is indisputably evident, the nearer the external air is admitted to the heart or middle of the stack or mow, the less chance there is of its being injured, and the sooner it may be stacked. That even farmers themselves are sensible the admission of air is necessary, is clear from the pains they take to have air-holes in their barns: why then will they act so contrary to their own conviction, and to common sense, as to pile up their corn within a building, when it can be so much better aired in the rick-yard; and even to pack it so close that no air can possibly be admitted, when at the same time they have numbers of air-holes for the very purpose of admitting it?

As gaining time to get a crop in safety is so precious an object to the farmer when his corn is cut down, it migh perhaps be an easy and a safe method to build it in oblong ricks, rounded at the ends, as will be shown hereafter, in considering the nature of stacking grain, which might be done very soon after it is reaped. The width of these ricks to be according to the state of the corn, that is, from five or six feet to about eight feet, but not more; or perhaps as wide as nearly the length of two sheaves, so as to give them a sufficient hold of each other to bind properly. Their length may be of any extent judged most convenient. The advantages of this mode are, 1. That the corn may be much sooner put together in safety than in the common way. 2. That staddles for building these ricks on will be very easily and cheaply erected. 3. That the expense of thatching will be less than in round stacks of the same contents. 4. That they may be finished and thatched at one end before the other is completed. 5. That when wanted to be threshed, by beginning at one end, no more need be taken down than requisite or convenient to thresh at that time, and that end may be secured from the weather by tarpawlings, or otherwise, or by a sliding cover, on the same principle as his majesty's ingenious moveable barn at Windsor. *Pl.* V. *fig.* . Stacks built in this manner, or even in the common way, are, therefore, most undoubtedly preferable to housing the corn, and may even be built at much less expense than in a barn.

The expense of thatch is but trifling: for after it comes off the stack it will answer, he thinks, the purpose of litter for work-horses or cattle, equally well as it did before.

If a farmer has not straw sufficient to thatch his stacks, he may, with a threshing-mill, get as much in half an hour, or an hour, as he has occasion for.

Here is another great advantage of a threshing-mill; for, if properly constructed, although it may bruise the straw a little, it does not cut it so as to prevent its answering the purpose of covering stacks; for which purpose oat or barley-straw, drawn even, and properly laid on, will do sufficiently well, as can be testified by the experience of many.

The third reason for housing corn is so much overbalanced by the advantages pointed out in the objections to the other two, that it is unnecessary to enlarge upon it; besides, as no farmer, who studies his own interest, and the great importance of dispatch in all his operations, will ever now think of using a flail if he can get a threshing-mill; he must be satisfied that no such reason can, in that case, have the smallest weight.

The great and principal object with a farmer, when his crop is cut down, besides securing it from vermin, is to preserve it in the completest manner from wet or dampness, or becoming mouldy. To attain this, after being properly secured from external moisture, it must be acknowledged, that a free admission of air is absolutely necessary. It is observed, that all sorts of corn in the straw, soon after it is built in a stack or mow, generally sweats a little, or, what in some places is called, *comes again*, however dry it may have been put up. This will happen in a greater or lesser degree, according to the state of the atmosphere at the time of its being put together. If this is the case, which every experienced farmer must know, it is evident, that without a free admis-

sion of air it is hardly possible, after this sweating, to restore the mow to its former dryness, or to prevent it contracting a mouldiness that must greatly injure both the corn and the straw.

On a tour lately made through great part of England, the author says, he had many opportunities of examining the condition of corn and straw piled up in large barns, and he observed but very few instances where the mow had not contracted a considerable degree of mouldiness; besides, they were so infested with rats and mice, that the damage done by those vermin must have been immense, although some farmers seemed to consider it as a mere matter of course, and gave themselves no trouble about preventing it.

It is wonderful, says he, that husbandmen should be so blind to their own interest as to suffer the depredations of those mischievous vermin, without using every effort to prevent it. They loudly complain of the hardships of the clergyman's dues, but allow those useless and destructive depredators to prey upon their property, unmolested and uncomplained of. In every county, and every parish, there ought to be associations for the purpose of destroying and annihilating those vermin. We are told, that in one county the tenants in the neighbourhood of a wood, conceiving themselves greatly injured by the immense numbers of crows resorting to that wood, entered into an association for the purpose of destroying them; they assessed themselves at the rate of five shillings, and latterly at two shillings per plough: out of this fund they paid a bounty of a penny a head for old crows, and from 2*d.* to 6*d.* per dozen, as the season advanced, for young crows. The first six or seven years from 10,000 to 7 or 8,000 were destroyed annually; and in thirteen years 76,655 were in all destroyed, the expense of which cost 142*l.* 14*s.* being a trifle short of 38 shillings per thousand; whereas, if the damage done by a crow in one year is estimated at one penny only, the waste committed by a thousand will amount to about four guineas. But the rat is far more destructive than the crow, especially when we reckon the damage they do to sacks, harness, &c. and the difficulty and expense of cleaning wheat when mixed with their dung.

Were such associations general, and a premium given for every rat destroyed, they might soon be extirpated, and an immense quantity of grain annually saved to the nation.

Security from vermin, and a free ventilation, being so essentially requisite for the preservation of corn in the straw, and as these cannot be obtained if lodged in a barn so effectually as by building upon proper staddles in a well-aired rick-yard, it is hoped that farmers will adopt this method more generally; which would not only be the means of increasing their profits, but, by abolishing those large expensive barns, would lessen the expense of farm-buildings so much, that a landlord would not consider it so very serious a matter to give his tenants a new and commodious set of offices when necessary. Where the flail is used, the greatest pains should be taken on the construction of the barn-floor; in making which, there are various ways practised for rendering them as firm and as dry as possible. Flues, or drying-floors, might also be used, and would be very beneficial in damp seasons.

But notwithstanding the housing of corn in the straw appears so perfectly unnecessary, and even so detrimental; yet, as many people are partial to this method, the few following plans are given of barns calculated for that purpose; afterwards those on a different construction for threshing-mills, the principal difference being, that the latter are not so large, and have granaries above; for where the former kind are already built, there would be no difficulty in erecting a threshing-mill within them also, if required.

The following is an explanation of the plates. At *fig.* 1. *pl.* V, is shown the elevation; and at *fig.* 2, the ground-plan of a small English barn, according to the common construction employed in most parts of the country for the smallest farms. *a b c d* is the threshing-floor. *a b* a cross wall about three feet high, sometimes built to keep the threshed corn from mixing with that which is unthreshed. *e* is a place for putting the threshed corn out of the way till the whole is threshed, or time had to clean it, and put it elsewhere. This place is about three feet high, and covered over with boards, but open on the side next the threshing-floor of the barn.

And at *fig.* 3, is seen the elevation, and at *fig.* 4, the ground-plan of the double English barn, with two threshing-floors *a* and *b*. In this kind of barn there is sometimes a cross wall built at the dotted line *c*. Barns of this nature are often erected of a large size, and at a great expense, and yet have seldom any sort of conveniences whatever for storing the corn after it is threshed, or for any other purpose except piling it up in the straw.

At *fig.* 5, is shown the elevation of an improved English barn; and at *fig.* 6, the ground-plan, in which *a* is the threshing-floor; *b*, place for laying the threshed corn; *c*, stairs up to a small granary, under which is a place for keeping potatoes, &c. At the other end of the barn is also a division *d*, which may be appropriated to different uses, as keeping implements, rearing calves, and other similar purposes.

Fig. 7, shows the elevation of a moveable Dutch barn; and *fig.* 8, the ground-plan, in which No. 1. is the threshing-floor, 16 feet by 12 feet, boarded 4 feet high, next the repository-bay. No. 2. the repository-bay, 16 by 8, boarded quite to the top, next No. 3, except a pitching-hole, which secures the barn by a wicket.

No. 3, is another bay, 16 by 8, open at the end, with a view of clasping 8 feet of the long rick, which is supposed to join it, and to be of a little less scantling than the barn; this length of eight feet is to be cut from the rick, and thrown into No. 2, where it is secured, and so drawn on as fast as it can be cleaned on the inside.

The barn is to stand on six wheels of two feet diameter, three on each side. And as no carriages ever come into such barns to bruise the floors, deal answers the purpose, and there needs only a single door of four feet width on each side.

The height of the barn, from the floor to the wall-plate, is 12 feet.

	£.	s.	d.
A barn of this kind, which was built for his majesty at Windsor, is entirely of deal, and cost by contract, including all materials of wood, iron, and every thing but thatching - - -	47	5	0
The covering, which is always best to be reed, reckoned at 1*l.* 1*s.* a square, including the roofing, and containing 8 squares, amounts to - - -	8	8	0
	55	13	0
But, in order to render it more useful, by making it more easy, a wooden groove has been added, which may be considered equal to - - - -	7	7	0
The whole expense with a wooden groove is therefore - - - - -	63	0	0

At *fig.* 1. *pl.* VI. are contained two elevations, a section and plan of a barn, with a threshing-mill that goes by water, cleans the corn at the same time it is threshing it, hoists it up into the granary above, grinds it into meal, and makes pot or pearl-barley, all by the same water-wheel. This barn and these mills were erected by Mr. Beatson, in the year 1792, at Kilrie, in Fifeshire; and he has found them to answer so extremely well, that besides the advantages of the threshing-mill, the other mills pay near 20 per cent. of the whole original outlay. The threshing-mill, he says, has sometimes threshed and cleaned in the space of one hour above 12 bolls of oats, which is more than 71 Winchester bushels, and requires six people to attend it while threshing at this rate. The following is a general description of the building, mill, &c.

Fig. 1. Elevation of the front. The end *a* is intended to be joined to other offices, as stables, &c. leaving an arch 10 feet wide to admit loaded carts to the barn. 1. A door into the side of the barn, and to the upper part of the mill; 2. door at which the straw is thrown out when threshed; 3. door into the lower part of the mill; 4. the water-hole, through which the water is conveyed in troughs to an overshot water-wheel; 5. back spout, in which the water runs, when set off the water-wheel; 6. windows of the granary.

Fig. 2. is a longitudinal section, or rather a view of the inside, showing the position of the machinery and manner of working the threshing-mill. *a b* level of the barn-floor. *c d* level of the lower mill-floor. *e f* level of the upper mill-floor. *g h* granary-floor. 1. threshing-mill, with hopper and fanners below; 2. person feeding the threshing-mill; 3. person raking away the straw; 4. person handing up the sheaves of corn to the feeder. Besides these, it requires one or two to shake the straw, and sometimes, if much water be on, another person to feed the mill. 5. Chaff-hole; 6. water-wheel; 7. water-troughs; 8. back spout; 9. the corn-mill and hopper, &c.; 10. sack-tackle for hoisting sacks into the granary; 11. partition of a small writing-office in the angle above the water-wheel; 12. door into the kiln, which has also a spout from the granary. The barley-mill is not represented here, as it would conceal some of the other machinery.

Fig. 3. Is the end elevation. 1. Water-troughs which conduct the water into the aperture 4, shown in *fig.* 1.; under these troughs loaded carts, &c. go to or from the mills or barn-yard; 2. window (for uniformity's sake), out of which the water comes when let off the wheel, as shown by the spout at 5, *fig.* 1. and 8, *fig.* 2.; 3. window of the writing-office; 4. opening to the water-wheel when necessary to grease the outer gudgeon, or to repair or examine the wheel; 5. kiln for drying corn upon wire-cloth; 6. a close shed (in some places called the kiln logie) for keeping dry the fuel when using it, and where the person sits to feed the fire.

Fig. 4. Ground-plan; *a*, the barn; *b*, large door, which admits a loaded cart into the barn; *c*, lower mill; *d*, water-wheel; *e*, herst framing, within which are the pit-wheel and the three iron pinions that move all the machinery; *f*, situation of the barley-mill; *g*, fanners for cleaning the shelling or oats, when the husks are taken off in the first process to prepare them for grinding; *h*, threshing-mill fanners, which blow the chaff backwards into the chaff-hole *i*; *k*, lower part of the kiln where the fire is put; *l*, kiln logie; *m*, the miller's house.

The whole expense of this building and machinery, which would suit a farm of any size, exclusive of carriages, did not, it is remarked, exceed 400*l.* being much less than is often laid out in some places on barns, affording no other convenience than for storing corn in the straw.

Pl. VI. *fig.* 5, represents a front and end elevation and plan of a barn and horse threshing-mill, upon a smaller scale: the mill being for three or four horses or cattle, and is supposed to clean or winnow the corn at the same time it is threshing it. It may also be made to hoist it up to the granary above, and to split beans or cut straw, if required, and to perform several other operations, as churning, pumping, grinding, &c. This barn and mill may suit a farm of any extent. The shed over the horse-path and first movements is generally made with a conical roof, and for no other use than covering that path; the expense of this roof is considerable, it is, therefore, proper it should be made to answer other purposes besides. In this design it is made square, as shown in *fig.* 6. by *a b c d*; the dotted circle is the horse-path, in the centre of which stands the upright axle at *e*, *fig.* 7. Above this, by carrying up the pillars to a proper height, is obtained a very convenient place either for putting corn in the straw till threshed, or for keeping straw or hay; or it may be made to serve the purpose of a granary. In either case, however, it will be necessary to construct the floor, so as to support the weight upon it without sinking in the middle. A communication with the barn may be made near the threshing-mill at *f*, in *fig.* 8. which would afford an easy access to the mill, in case of corn being lodged

there to be threshed. The threshing-mill in this barn is erected on a floor about seven or eight feet above the ground-floor, to give room for the fanners or winnowing-machine below it. This floor may be extended the whole breadth of the barn, and about 15 feet or more towards *i*, from the back part of the mill at *f*; by which, and being properly partitioned below, a very necessary and useful division *f g h i* may be got for containing the clean corn till hoisted up to the granary. The doors of this place may be locked by the farmer, if he chooses, to prevent any other person having access to his unmeasured corn, even while threshing it. The space at *k* will contain the chaff blown from the fanners. There is a door through the partition at *g*, to render the communication more easy and expeditious from the part L, where the unthreshed corn is laid, as it may be necessary to look frequently below while the mill is going; there might also be a door in the partition at *h*, but this is not so necessary, for the farmer can easily see what his servants are about at M, where the straw goes, by standing on the threshing-mill floor, to which there should be steps up at *n*. This threshing-mill may be made also to rake away the straw, and to throw it down to the part *n*; which will save a person raking from the mill. The expense of this threshing-mill, if made to clean the corn and rake away the straw only, which in general will be found sufficient, will amount to about 50*l.* exclusive of flooring, &c. If made to hoist up the corn, to split peas or beans, and cut straw, from six to ten pounds more for each of these operations; and for other machinery, according to the manner of constructing it.

Mr. Beatson farther observes, that barns with threshing-mills might be constructed for wind, but that where water can be had, it is by far the best manner of working them.

In most of the large barns now used, he thinks there would be no difficulty whatever in erecting threshing-mills, and acquiring every other convenience necessary. The principal thing, he says, is to obtain a person intelligent in those matters, who can plan out the building as it ought to be, and afterwards construct the mills properly.

Barn-*Floor*, the portion, space, or floor in the barn, on which the grain is threshed out by the flail, or any other means. It is for the most part made in the middle of the barn, but may be laid down in any other part, if more convenient, and should always be so formed as to be perfectly close, firm, and strong. It is sometimes called the threshing-floor. In constructing these kinds of floors, various sorts of materials are employed, such as compositions of different earthy kinds, stones, lumps or bricks, and wood. The last substance, when properly laid and put together, is probably the best and most secure from such causes as are liable to injure the grain, such as those of damps, &c. The floors of barns, when made of wood, are sometimes so contrived as to be moveable at pleasure, which is a great convenience in many cases. Barn-floors are made of different dimensions, but from twelve to fourteen by eighteen or twenty, are in general proper sizes for most purposes.

In Norfolk, according to Mr. Marshall, twenty-four feet by eighteen is considered as a well-sized floor; twenty by fifteen a small one. Indeed, a floor of less dimensions is ill adapted to the Norfolk method of cleaning corn; which is universally effected by casting it with shovels from one end of the floor to the other. To obtain this necessary length of floor, a porch, on one or both sides of the barn, is almost universal. A lean-to porch, with double doors to let out an empty waggon, and with a range of lean-to sheds or hovels on either side, continuing the roof of the barn without a break to the eaves of the porch and sheds, is at present deservedly in good estimation. Barn-floors, he says, are of plank, "lumps," a kind of bricks, or clay: the last are most prevalent; and although they be considered as inferior to the first sort, they are in better esteem in Norfolk than in most other places.

It is observable that, notwithstanding the spaciousness of the Norfolk barn-floor, the labourers, in general, object to their threshing two in a barn, rather choosing to work singly: this, perhaps, is principally owing to the particular method of threshing with two on a floor, which is, to turn their backs on each other, working as separately as if they threshed on separate floors; the method of standing face to face, and giving stroke for stroke, being seldom, if ever, used.

But in Gloucestershire, the same writer observes, that barn-floors are of a good size, when from 12 to 14 by 18 to 20 feet. The best of oak, some of stone; but a species of earthen-floor, which is made there, is thought to be superior to floors of stone, or any other material, except sound oak-plank. The superior excellency of these floors is, he says, owing in part to the materials of which they are formed, and in part to the method of making them.

And as the floor or threshing-place is the principal part of every barn, the greatest care ought to be taken in making it. In order to this, in some places, the surface of the intended threshing-place is dug away to the depth of about six inches, and the earth thus taken out, when of a proper kind, after being well cleared of stones, is mixed with the strongest clay that can be procured, and with the dung of cattle. This mixture is then worked together with water, till it is of the consistence of stiff mortar, and the compost thus made is spread as smooth as possible with a trowel, upon the spot from whence the earth was taken. As it cracks in drying, it must frequently be beaten down with great force; or rolled with a heavy roller until all the crevices are filled up: and this must be continued till it is quite solid, hard, and firm.

The best barn-floor, both for threshing upon and for keeping corn, is that which is the driest, smoothest, most completely solid, and consequently freest from cracks and holes, in which insects and vermin may shelter themselves, and breed. The ancients were remarkably careful in this respect, as is evident from the writings of Cato, Varro, and Columella. The last of those excellent writers relates particularly the great pains they took, first to dig up the ground to some depth, in order to moisten it with fresh lees

of oil, but not with any that had saline matters in them; then to mix it thoroughly with chaff, and ram it down as close as possible; afterwards as it dried, to stop all the cracks and crevices that appeared, to continue beating it down with great force, to render it quite level; and, lastly, to strew it again with chaff, which they trod in, and then left it to be completely dried by the sun. All of them agree, that the lees of oil, thus used, prevent the growth of weeds in the floors, and contribute to preserve the corn from being plundered by the mice and ants. In this they were, however, probably mistaken. Their barns were always seated high, and as dry as possible. A floor made in the above manner was probably preferable to either stone, or the earthen floors common in many parts of England, from which such dampness has been communicated to the corn, as has rendered wheat, for example, much a bushel worse, either for keeping or exporting.

Boarded threshing-floors, made of sound, thick, well-seasoned planks of oak, are excellent for service, will last a long time, and may be converted into good floorings for rooms, by plaining them down, after they are become too uneven for the purpose originally intended.

Earthen floors should not be advised, except where good materials can be procured, and the making of them be performed in the most perfect manner, which is only the case in particular instances and districts. But though wood must probably be considered as the most appropriate sort of material for this use, bricks, when well laid down, may, in some cases, make a tolerable floor for many purposes; but on account of their not only attracting, but retaining moisture, are highly improper, and not to be recommended, where grain of any kind is to continue much upon them.

There are many different methods of constructing and laying down barn-floors, when formed of wood. The most usual is that of nailing the planks, or boards of which they are composed, after their edges have been shot true, and well fitted and jointed, close down to wooden joists or sleepers, firmly placed and secured upon the ground, or other place for the purpose. But in the midland districts, Mr. Marshall says, another practice is pursued in this business; for, in speaking of barn-floors in these districts, he says, a peculiar method of laying is in use. Instead of the planks being nailed down to sleepers in the ordinary way, the floor is first laid with bricks, and the planks spread over these, with no other confinement than that of being "dowled" together, that is, ploughed and tongued, and their ends let into sills or walls, placed in the usual way, on each side the floor. By this method of putting down the planks, provided the brick-work be left truly level, vermin cannot have a hiding-place beneath them; and a communication of damp air being effectually prevented, floors thus laid are found to wear better than those laid upon sleepers. It is observable that the planks, for this method of laying, ought to be thoroughly seasoned.

It is evident, however, that where barn-floors can be made hollow, they must be much better for the purpose of threshing upon, than such as are either placed on brick-work, or the ground. From their greater pliability and elasticity in threshing upon, the grain is of course threshed out with more ease, certainty, and dispatch. But in whatever manner these floors are formed or constructed, they become expensive, and do not last any great length of time. Such as are laid on the common ground upon three sills or sleepers, with two inch oak-planks, will in general cost from eighteen to twenty pounds, and only last fifteen or twenty years. And such as are made hollow, and placed wholly on brick-work, or only on brick quoins, with two inch and half oak-planks are still considerably higher, being often from twenty-five to thirty-five pounds or more, and not, in general, much more durable. Beech-floors, which have lately been introduced instead of oak, have been found not to last more than seven or eight years; consequently to be by no means advantageous in this intention. When made hollow they, however, possess a superiority.

And, according to Mr. Marshall, the advantages of a chamber barn-floor are dryness, cleanness from dirt carried in with the feet, and security against pigs, poultry, and other accidents to which ground-floors are more liable: for threshing wheat upon, chamber-floors are obviously preferable to ground-floors, most especially in low dirty situations.

In order to obviate the continued heavy expenses of these sorts of floors, as well as the great consumption of timber in the construction of them, and also to guard against the great waste of grain upon them after they begin to decay, and get out of order, another kind of barn-floor has been invented by Mr. Upton, of Petworth, in Sussex, which, on trial, has been found to prevent these inconveniences in a great degree, and at the same time to afford other great advantages, such as those of being more easily drawn upon by loaded waggons or carts; providing, when down, comfortable shelter for hogs; and, when turned up, being capable of being employed as a stable, ox-stall, hovel, or cart-house. The inventor has termed it a *moveable barn-floor*, and which, it is said, can be moved with great readiness, being placed or displaced in a very short time, as a few minutes, merely by the power of two persons. This new sort of hollow floor is constructed of oak-plank, five feet eight inches in length, and one inch and an half in thickness, and costs about twenty-three or four pounds. As these dimensions are much less than those commonly made use of, much advantage is obviously gained in the timber. And planks of deal, beech, and elm, may be made use of, as they will not be liable to decay from there being little or no dampness, and in this way the expense be lessened. And where timber from the estate is employed, it may be still farther diminished, as these floors may be composed of stuff of small scantlings, which may be had from short timbers, of but little value in comparison to those made use of in other kinds of barn-floors. Mr. Upton supposes, that floors constructed in this method will last an hundred years, or as long as the barns, as they are perfectly free from damps, from their being so much raised from the ground when down. From their being moveable, where there are more barns than one in the

same yard, they may be conveyed from one to another, and by that means save the vast expense of having so many different floors.

At *fig.* 1. *pl.* VII. may be seen the representation of a barn-floor of this kind; one part of which affords a view of the floor, as laid down for threshing upon, and the other part raised up, with racks for feeding cattle, &c. *a*, rack-boards; *b*, slip-boards, for admitting air; *c*, wooden floor cills for the slip-boards *b* to rest upon; *d*, moveable floors, to one part of which are wooden legs, serving to support it, when it is necessary to put the displaced timbers into the recess *e*; *e*, a recess for receiving the threshed grain before it is winnowed, or for containing the moveable timbers in; *f*, an iron hook to lift the floor up with when not used for threshing upon. There are two of these hooks employed in the barn. *g*, the moveable timbers that support the floor, having grooves along their surfaces, to prevent the loss of grain; two of these timbers are represented larger at *gg*, one being the cross-piece, with a leg and tenon for fixing in the stone mortice; the other intended to lie lengthwise, and level with the floor of the barn. In the ground are fixed stones with mortices in them to receive the tenons of the timbers described above. *h*, the ground, which should be made of materials sufficiently hard to prevent the horses, carts, or waggons, from making depressions in it; *i i*, posts with iron hasps, to support the floors when out of use; *k*, racks for feeding cattle at when the barn is applied to other purposes than threshing upon. When the floor is not wanted for threshing upon, the floors may be first turned up, and fixed with the iron pins, bolts, and hasps, then the middle timbers taken out and placed on the ground, on the side opposite to the recess, where they are to be deposited when out of use; afterwards, that part of the floor which has legs to support itself by, must be let down, putting the timbers into the recess, and turning the floor up again.

It is probable, that floors of this nature may be both useful and convenient, in cases of extensive barns, where, from the want of proper threshing-machines, the flail is made use of; but, in other cases, from their being complex, and requiring much room when out of use, as well as trouble in fixing, they do not, however, appear to have any particular advantage over those that remain fixed in their proper situations.

Barn-*Yard*, a term applied to the straw or fold-yard. It is that which immediately adjoins the barn or stack-yard.

BARNACLES, a name given to horse-twitchers, or brakes, a sort of instruments used by farriers to put upon horses' noses, when they will not stand quietly to be shod, bled, or dressed. There are several sorts of barnacles: the common sort are rollers of wood bound together, to hold the horse's nose between. Another sort has handles, and are therefore termed pincers, to distinguish them from the foregoing. And a third sort are held together at the top by a ring inclosing buttons, having the top buttons held by an iron pin rivetted through them.

BARNED, a term used to signify housed or secured in the barn.

BAROMETER, an instrument constructed for the purpose of measuring the state of the atmosphere, in respect to its weight and pressure, so as to show the variations in the air that indicate changes in the weather. That a good instrument of this kind is essentially necessary to the farmer, on various occasions, is sufficiently evident from the following statements. It must be plain to every one, "that each year, and the various seasons of the year, have a peculiar character as to rain, drought, heat, cold, &c.; and as the quality of the seasons has a most sensible effect on the productions of the earth, it is evident that it must be of the greatest advantage to the farmer to foresee the changes that may be expected, because he can thereby regulate his labours accordingly." In the drill, and many other systems of husbandry, this is particularly the case. "When the character of the season is once ascertained, the returns of rain or fair weather may be judged of with some degree of certainty, in some years, but scarcely guessed at in others, by means of this instrument; for in general we may expect that when the mercury rises high, a few days of fair weather will follow. If the mercury falls again in two or three days, but soon rises high, without much rain, we may expect fair weather for several days; and, in this case, the clearest days are after the mercury begins to fall (contrary to the general expectation, perhaps). In the same manner, if the mercury falls very low with much rain, rises soon, but falls again in a day or two, with rain, a continuance of bad weather may be feared. If the second fall does not bring much rain, but the mercury rises gradually pretty high, it prognosticates settled good weather of some continuance, when a heavy rain has fallen upon the mercury's sinking, and its continuing ste[illegible]ly low, the weather is sometimes fair and [illegible] i[illegible]es well; but no prudent farmer should trust to such appearances. There is, indeed, a caution, which every observer may profit by. When the mercury rises high in the barometer, the moisture on the surface of the earth disappears; this, even though the sky be overcast, is a sure sign of fair weather; but if the earth continues moist, and water stands in shallow places, no trust should be put in the clearest sky, for it is in this case deceitful. In the latter end of March, or generally in the beginning of April, the barometer often sinks very low with bad weather, after which it seldom falls lower than 29 deg. 5 min. till the latter end of September or October, when the quicksilver again falls low with stormy winds, for then the winter constitution of the air takes place. From October to April, the great falls of the barometer are from 29 deg. 5 min. to 28 deg. 5 min. and sometimes lower; whereas, during the summer constitution of the air, the mercury seldom falls lower than 29 deg. 5 min. It therefore follows, that a fall of one-tenth of an inch during the summer, is as sure an indication of rain, as a fall of between two and three-tenths is in the winter. It must be observed, that these heights of the barometer hold only in places nearly on a level with the sea; for experiments have taught us, that for every eighty feet of nearly perpendicular height the barometer is placed above the level of the sea, the quicksilver sinks one-tenth of an inch. Observation,

therefore, alone, must determine the heights of the mercury, which in each place denote fair and foul weather."

It is added, that "very heavy thunder-storms happen without sensibly affecting the barometer, and in this case the storm seldom reaches far: when a thunder-storm is attended with a fall of the mercury, its effect is much more extensive." And here it may be remarked, "that when the quicksilver falls very low, the weather continuing mild, and the wind moderate, a violent storm happens at that time in some distant place: this will account for a seeming false prognostic that the barometer has often been unjustly charged with." The effects which heat, cold, and wind, severally produce on the glass, independently of the dry or humid condition of the atmosphere, should likewise be considered. It is the opinion of a writer of a paper in the Agricultural Magazine, that this is "as useful an appendage to an agriculturist, as almost any of his implements; for unless his operations are conducted with an observant eye to the present or probably future state of the weather, as well as soil, the produce of his labours will fall short of his expectations, or (what is equally fatal to him) will suffer from ill-timed, though otherwise commendable exertions to house it."

BARRED SHOES, in *farriery*, are shoes constructed for the purpose of preserving the frog of the horse's foot. See *Shoeing*.

BARREN *Corn*, a term applied to a distemper in corn, in which the ears of such kinds of grain as are affected, as wheat and rye, which are the most subject to it, are long, lean, and white; in some, the stamina, or small threads in the middle of the flower, are dry, transparent, and horned; the female organs are small, whiter, and less velvety, than in healthy ears: in others, the filaments are swelled, the apices, or knobs on the tops of the stamina, void of dust or farina, and the stigmata badly unfolded. The stigmata of all the blossoms of an ear are sometimes dried and parched, and at other times the apices are swelled.

Barren *Earth*, a term given by some writers to particular sterile soils, and also to the under stratum, or that which lies below the bed of mould, which is most frequently turned up, and cultivated for the nourishment and support of plants.

The notion, however, of the under stratum of earth being barren, and improper for the nutrition and support of plants, seems to be founded in error, as every kind of earth, whether it be near the surface or at some depth below it, is found capable of giving nourishment to plants, provided it be for some time exposed to the influence of the atmosphere, and the effects of frost, &c. Earth, seemingly barren, dug out of a deep pit, will, when spread on the surface, and properly stirred and exposed, be soon in a condition fit for the purposes of vegetation, even much more so than that which, having been long at the surface, is almost exhausted, and rendered improper for vegetation by the number of vegetables it has successively nourished. The idea of an earth being barren, merely because it is placed at a distance from the surface, is, indeed, by the most intelligent agriculturists now quite exploded; its particles may perhaps want a proper arrangement, but always possess the vegetative quality, as has been proved by repeated experiments.

Barren *Lands*, are such lands as naturally, or for want of culture, on being sown, either produce no crops at all, or such poor ones as will not repay the expense of tillage.

Barren *Soils*, are those kinds of soil, which, from the nature of their constituent principles, are incapable of producing good crops. Mr. Kirwan says, that in such soils the proportions of

Silex are from	42	to	88
Argill	—	20 —	30
Calx	—	4 —	20

Hence, the troy pound contains, allowing for water, 120 grains,

Silex from	2368	to	4963
Argill	—	1128 —	162
Calx	—	225 —	620

The specific gravity of these soils is not ascertained; but it probably is either much above or much below that of the other kinds of soil, as they are either too close or too open. Mr. Fabroni found that of barren sandy land, 2,21.

Barren *Springs*, such weak oozing springs as are injurious to lands, when suffered to flow or run over them. Waters that flow from coal-mines, or through mineral strata, have frequently this pernicious quality; and such also as contain either aluminous or ferruginous materials in a state of solution in them.

RARRS, in *farriery*, a term applied to those portions of the crust or hoof of horses that are reflected inwards, and which form the arches that are situated between the heels and the frog. According to Mr. St. Bel, they are formed "by the continuation of the fibres of the heels, which turn towards each other; and advancing to the extremity of the frog, where they meet, form an acute angle; aud acting by mutual resistance from within, outwardly oppose the contraction of the heels." See *Foot*.

Barrs *of a Horse's Mouth*, the fleshy rows that run across the upper part of the mouth, and reach almost quite to the palate, very distinguishable in some young horses. They form that part of the mouth on which the bit should rest, and have its effect.

They should be sharp ridged and lean; for since all the subjection a horse bears proceeds from these parts, if they have not those qualities, they will be very little or not at all sensible; so that the horse can never have a good mouth: where they are flat, round, and insensible, the bit will not have its effect, and consequently the horse cannot be easily governed by his bridle.

BARTH, a provincial term, which signifies a warm inclosed place or pasture for calves, lambs, and other young animals.

BARTON, or BARKEN, a term employed in some districts to signify the yard of a farm-house.

BASKET, a well-known useful utensil, made from twigs interwoven with each other. It is constructed in various shapes, and employed for various purposes in husbandry.

BASON, a hollow or excavation formed in the

ground for the reception and preservation of water. Reservoirs of this kind are extremely useful in many situations, for the supplying of cattle with water, and for other purposes, and should always be proportioned to the nature and size of the farm.

One great object in making basons is, to consider whether a proper supply of water is to be obtained at all times of the year. And another thing is, the means of making them hold water completely at all seasons. This is done the most effectually by laying the bottom and sides of the cavity thereof with strong clay, twelve, fifteen, or eighteen inches thick, according to the quality of the natural soil: for the more the bottom soil inclines to a light, loose texture, gravelly or sandy, the greater thickness of clay must be allowed; but where the soil below is naturally of a strong loamy or clayey kind, there will be little difficulty in making it hold water with a moderate thickness of additional clay. In default of clay for the above purpose, chalk is sometimes used in countries where it abounds, first forming it into a powder, then working this into a sort of mortar, with which the bottom and side walls are formed, beating and ramming it hard, observing the thickness as above.

Some also, instead of clay, work the bottom and sides a foot thick with masonry of brick, or small stones laid in terrass, and plaster it over with two or three inches thickness of cement, which is two-thirds of powdered tile to one of lime, beating it well with as little water as possible into a strong mortar; and after this is laid on, rub it over with oil or bullock's blood, by which it hardens under water like stone.

The depth of basons need not be more than three feet, though some are made considerably deeper; but four feet is depth enough for any purpose. The sides of the cavity of the bason should be formed with a gradual slope, from the top of the circumference to the intended depth, and the whole laid with clay, to render it water-tight, as before directed, and a few inches of gravel over that, to preserve it, and render the water clear.

In setting out the dimensions of basons, observe, that where a full coat of clay is necessary, it must be staked out three feet six inches at least wider than its intended width, to allow a twelve or fifteen inch stratum of clay on each side, and five or six inches of gravel over the clay; it should also be eighteen inches or two feet deeper than you design the depth of water, because the bottom ought to be clayed from twelve to fifteen or eighteen inches thick, and five or six of gravel.

In digging out the cavities of basons, begin towards the middle, and excavate the earth the intended depth, as above; then work off the sides regularly with a moderate slope from the edge of the circumference to the bottom of them.

When the cavities of the basons are formed, let them be well rammed and smoothed: then the clay is to be brought in, which should have been previously well wrought over and trod; and begin laying the bottom in the middle, being careful that no stones, sticks, or such materials, be mixed therewith, to occasion fissures to let off the water; spread it regularly, a little at a time, and tread it with men's naked feet, casting water thereon frequently, ramming it also from time to time with wooden rammers, observing, if the bottom soil is of a light or loose nature, to lay the clay fifteen or eighteen inches thick, and see that every part be well kneaded, that there be not the least vacancy; for the water will escape at the smallest cranny, and occasion great trouble afterwards. During the work, if the weather is dry, cover the clay as you lay it with mats or moist litter, or with the intended necessary stratum of gravel, laid the thickness mentioned below, to prevent the clay from cracking, continuing the claying regularly each way from the bottom to the top of the circumference of the bason; and as soon as the whole is clayed, cover it immediately with a stratum of coarse gravel, four, five, or six inches thick, which secures the clay, and renders the water always clear: and when thus far finished, let the water be got in as soon as possible.

BASS, a term used to signify a mat. See *Mat.*

BASTARD ALKANET, a weed common among corn, especially rye. It may be easily known by its red roots, which yield a red tincture, much used by the young girls in Sweden to colour their cheeks. From the root usually rises a single stem, about a foot high, rough, and branching out at the top. The flowers are small and white, surrounded with five long, narrow, hairy leaves, forming what the botanists call the empalement of the flower-cup, and succeeded by four white rough seeds. It is called also *bastard-gromill*, or *salfern*. See *plate* III. *fig.* 10.

BAT, a provincial term used to signify a blow.

BATEABLE, a provincial term used to express cattle's thriving on the food they eat.

This, Mr. Curtis says, is undoubtedly of great co sequence, and it is to be regretted that our knowl ge of bateable herbage is so limited. Of those plants which have been cultivated, we are however able to speak with some certainty; it is well known that clover, lucerne, sainfoin, tares, and several other plants, have a tendency to fatten cattle; but what grasses, or other plants, which have not been subjected to a separate cultivation, have this particular tendency, remains to be ascertained by experiment.

As leguminous plants in general are found to agree with cattle, we may reasonably conclude, he thinks, that a certain quantity of them must be proper in pastures. Certain pastures are found to be more bateable than others; but whether this arises from situation, or their particular produce, remains also to be discovered.

Bateable *Herbage*, such herbage as has the tendency of readily fattening stock of different kinds.

BATH, in *farriery*, is a fluid medium, in which animals may be immersed, either for the purpose of cleanliness or the removal of disease. They are either *cold* or *warm*; but the former is mostly used in the cure of diseases of domestic animals, and consists, in general, of simple cold water. This, by being heated, serves as a warm-bath, and may be of great utility in rendering the skins of many sort of animals clean and free from all sorts of filth and nastiness.

BATHING, in *farriery*, the act of using a bath of any kind in the cure of the disorders of animals. Cold-bathing has been found beneficial in the removal

of locked-jaw in a horse, in the practice of Mr. Moorcroft, an able veterinary surgeon, in London. It was applied by swimming the animal, at certain intervals of time, in a river or other water; and the same remedy has been applied in the removal of lamenesses, from rigidity in the muscles. And local bathing, where medicinal substances have been diffused in the water, has likewise been recommended by Mr. St. Bel, in some cases.

When the immediate effect produced by the use of cold or warm-bathing is attended to, it will be easy to perceive their utility in a variety of complaints. The cold-bath invigorates the system, increases the tone of the solids and circulation of the fluids, and promotes insensible perspiration; hence it becomes a corroborant, deobstruent, and general evacuant: whilst the warm and vapour-baths have the power of relaxing the solids, soliciting the fluids externally, and, by these means, greatly promoting the sensible perspiration, and may be considered as relaxants and evacuants.

On these principles, very powerful effects may be produced, where these means are judiciously employed.

BATTEN, a term applied to a scantling of any wood, which is from about two to four inches broad, and one or two inches thick. It also signifies strong broad fencing rails. It is sometimes written *Batton*.

BATTIN, a provincial term used to signify a truss of straw.

BAVINS, brush-faggots, or faggots made with the brush-wood at full length.

BAUSON, the same with badger. See *Badger*.

BAY, a colour in horses, probably so called from its resembling the colour of a dried bay-leaf. There are various degrees of this colour, from the very light bay to the dark, which approaches nearly to the brown, but is always more gay and shining. The bright bay is an exceedingly beautiful colour, because a bright bay horse has generally a reddish dash, with a gilded aspect, his main and tail black, with a black or dark list down his back. The middle colours of bay have also frequently the black list, with black main and tail. And the dark bays have almost always their knees and pasterns black; and we meet with several sorts of bays, that have their whole limbs black from their knees and hocks downwards. The bays that have no list on their backs are, for the most part, black over their reins, which goes off by an imperceptible gradation from dark to light towards the belly and flanks. Some of these incline to a brown, and are more or less dappled. The bay is one of the best colours of these animals; and Gibson remarks, that horses of all the different shades of bays are commonly good, unless when accidents happen to spoil them while they are colts.

Bay *of a Barn*, that part where the mow is placed. Hence, such barns as have the threshing-floor in the middle, and a space for a mow on each side, are called barns of two bays, &c.

BAYARD, a provincial term, which implies a bay horse.

BEACE, a provincial word used to signify cattle. It also sometimes implies a cattle-stall.

BEAGLE, a hunting-dog, of which there are several sorts, as the southern beagle, which is rather less than the deep-mouthed hound, as well as thicker and shorter. The fleet northern, or cat-beagle, which is smaller, of a finer shape, and a hard runner. By crossing the breed of these, an excellent sort, which are great killers, may be produced. There is also a very small sort, which is used for hunting the rabbit, and small hare, but which is too small to be of much use.

BEAL, a word applied to the bellowing of cattle.

BEAM, a large well-known thick piece of timber used in buildings.

Beam *of a Plough*, the upper principal timber into which the handles and all the other parts of the tail are fixed. It is most commonly made of ash-wood, somewhat bent in its form, and of different lengths, according to the nature of the plough.

BEANS, a sort of pulse, of which there are several kinds; but those which are best adapted to field-culture are of the smaller size, such as the common horse-bean, and the tick-bean. The large sort, or garden-bean, as the Windsor, long-pod and mazagon, have also been occasionally employed in the field, with some success, in some of the southern districts. Beans, of whatever kind they be, constantly prefer a strong moist soil, and on such, where proper culture is given, they mostly afford an abundant produce.

Tick-beans are supposed by some farmers to be more productive than horse-beans; but the latter grow higher in the stem, and produce a more stagnated state of the air, or smother the land more, consequently are the most suitable for the stronger sorts of soil. And Mr. Young remarks, that "the common little horse-bean has the advantage of all others in being more generally marketable; for, in certain situations, it is not always easy to dispose of ticks, Windsors, long-pods, and various other large sorts. They also grow higher, shade the ground in summer more from the sun, and yield a larger quantity of straw, which makes excellent manure. But some of the other sorts are generally supposed to yield larger products. This, however, is a point, he says, in which some well-conducted comparative experiments are wanting. In purchasing beans for seed, care should be taken to choose such as are hard and bright, without being shrivelled in their appearance.

The author of the Survey of Middlesex observes, that beans are a crop which thrive well in almost any soil that is rather strong, such as medium loams, sandy loams, clayey loams, and chalky loams; on clay, marl, chalk, and such like cool subsoils. And the author of the Farmer's Calendar says, that "every one knows, that all the sorts of strong and heavy soils, are the common ones generally applied to this sort of crop. In Kent, they wisely cultivate them to great extent, upon rich dry sound loams; but it is not, he conceives, generally known, and very rarely practised, to venture them on light turnip loams and middling sands. He has, however, seen them succeed so well on such, that the circumstance should not be overlooked, as it deserves the attention of the farmer in the beginning of February, to consider, whether he has not land upon his farm which will do for this crop,

although he never before thought of venturing it. "The soundness of a man's farming practice may, he thinks, be judged of by this cultivation, as well as by any other criterion: for he ought to have beans wherever it is possible to have them. They do not exhaust the soil—they prepare it better for wheat than any other crop—they stand erect to harvest, admitting horse-hoeing to the last; they shade the ground from the sun, and the straw is valuable, if harvested in a favourable time, or, if not so harvested, makes excellent dung. The favourable circumstances attending this crop, are, continues he, so many, that every man who can have them ought to determine on the culture. A bad crop of peas fills the land with weeds, but a bad crop of beans may be as clean as a garden. Some of the greatest products of this plant, which he has seen, were on a rich sand; but he has known beneficial ones on a sand of 10*s*. an acre. Beans are never seen in Norfolk, on sands that let from 10*s*. to 15*s*. and even more per acre; and this is a deficiency in their husbandry," in his opinion.

This sort of crop is put in after many different kinds, as barley and wheat; but to put in beans after clover, and other seeds, is, Mr. Young thinks, most excellent husbandry, and preferable to sowing wheat, which does better after beans, and also enables the farmer to get two profitable crops instead of one, with the land preserved at the same time in good heart, and clean. 1. Fallow, turnip, cabbage, winter-tares, or potatoes; 2. barley; 3. clover, &c.; 4. beans; 5. wheat." This is, he supposes, "a much more profitable course than that of four years ending with wheat; or of five years, by taking barley or oats after the wheat. But the clover lay should, he says, be dunged before wheat-sowing, if the time should be too dry for that operation after it, and then ploughed into such stitches as suit the drill-plough or scarifiers, and planted as below, without more ploughing. This is an excellent system, he thinks, that cannot be too much commended. The layer affords a good opportunity for carting the manure, which is wanting in some courses. And there are some rich soils, upon which the most profitable husbandry that can be practised is, he supposes, to take beans and wheat alternately; others on which the same husbandry may be repeated twice in five years, or thrice in seven. There may be one or more such fields on a farm; but, wherever found, this management should not be neglected. In all cases, the land ought to be ploughed in autumn; no spring-ploughing to be given; and the stitches drilled or dibbled at the season mentioned below, if the weather be favourable; if not, in March." It is still farther observed, that "from the wetness of the soil or season, turnip-land, after sheep-feeding, will sometimes be found in very bad order for barley. The general practice is, to persist in the intention for barley, and to effect a partial pulverization, by much tillage and patience: but if land is found in such order, it is much better, Mr. Young conceives, to give one deep earth, and to dibble in beans. For this grain, it is no objection that the land breaks up a whole and clung furrow, as the farmers term it. The beans succeed well, and the horse and hand-hoeings, with the effect of the seasons through summer, bring the land into proper order for scarifying for wheat. He has found this husbandry successful, and every one knows how easily a crop of barley is lost in such a case."

According to the same writer, "a successful bean-husbandry upon harsh and difficult soils, depends upon the exertions which are made in October, or, in favourable weather, in November. As soon as the farmer has finished his wheat-sowing (and before, if he has been delayed by drought), he should cart on the manure, all that is possible for beans. It is the wheat, barley, or oat-stubbles, or layers, which will come in course to receive it: if the wheat, the stubble must be mown and carted first; the manure then carted and spread, and the land carefully ploughed into that form on which the crop is in the spring to be drilled or dibbled. If the former, the stitches must be of the exact breadth which suits the drill-machine; if the latter, of that which is adapted to the scuffle and scarifier. The dung will lie safe, and the frosts will pulverize the surface, a main point for drilling, but not for dibbling. By means of effecting this before the bad weather comes, he will be able, if the weather be open, to get in the crop in February, which is of much importance. Let him be assured that there is no crop which will pay him better for dung than this."

It is supposed that beans are a crop that will not only pay very well for manuring; but that "if there are not many turnips, potatoes, &c. all the dung of the farm should be laid on for them, by way of a preparation for wheat; in which case the manure may be laid on at any time, when it can be done previously to the ploughing of the land."

And Mr. Middleton thinks, that the preparation for this crop should be as follows: Early in autumn lay the manure on, and immediately plough the land into ridgelets of two feet six inches wide; in which state let it lie until the season for planting, when the seed may be dibbled in, one row of beans into the middle of each ridgelet, at the distance of about three inches from bean to bean. They should be immediately covered, which may be done by children, with a garden-rake or hoe; or, should the land be dry and crumbly, a horse and a bush-harrow would do as well. In most places, he observes, it is adviseable to set a boy with a rattle to frighten away the rooks until the beans are up.

The distance between the rows will not prevent the crop from completely covering the ground, especially if the land was manured for them, as they will branch out sideways, three or four stout stems from each root. They should be early planted, in order to their getting sufficient root-hold of the land, and procuring shade against the hot weather sets in. It is also some security against the *black dolphin*, which is the greatest enemy the bean is ever attacked by. They require a soil that can seldom be worked without damage during the winter and spring; consequently it ought to be manured, and gathered into one-bout ridges in the autumn. The shape of these ridges keeps the land more dry through the winter than any other, and prevents excessive rains from washing away the manure, which had been previously folded by the

plough into the centre of such ridges; in which state it should lie until the season for sowing, when the land thus prepared will be so dry as to admit of dibbling nearly every fair day; which secures to the farmer the advantage of choosing his season. He dunged, he says, about ten acres in September, 1793, and ploughed the land into ridges of two feet and a half wide, burying the dung in the middle of the ridges. The land lay dry through the winter, and he dibbled one row of beans into the middle of each ridge during the first week of February, 1794. My neighbours, says he, on a similar soil, who ploughed into flat ridges of about fifteen feet wide, could not get their seed in till March. The ensuing summer was uncommonly dry: my beans being so unusually wide apart, admitted the plough and hoe to work as freely between the rows as a stubborn soil would allow. The plants tillered or branched till they completely covered the intervals, and the field appeared as completely cropped as though it had been sown broadcast. When my neighbours' plants, says he, were beginning to pod, mine were half set. The whole were alike attacked by the black fly, which reduced their crops to a bushel or two per acre, while I had twenty.

Mr. Banister thinks, that the proper time for planting beans is towards the latter end of January, or early in the following month; though this business may be continued to advantage till the middle or latter end of March, if the weather had prevented their being got in at an earlier season: but in general it is best to embrace the first opportunity of sowing them after Candlemas, as they often miscarry if the season be procrastinated beyond that time, especially if a dry summer should succeed.

But Mr. Donaldson, in his View of the present State of Husbandry, observes, that the ordinary mode of preparing land for a crop of beans, is to give one ploughing only, which is generally performed in the spring immediately before the seed is sown. Beans are for the most part sown broad-cast, either on the stubble, before ploughing, or on the new-turned-up furrows. Sometimes beans are sown or planted in the bottom of every second or third furrow, and afterwards horse and hand-hoed. In a few districts they are sown with a drill-machine, and at such distances in the rows as to leave sufficient space, either for hand-hoeing, when that only is intended, or for horse and hand-hoeing, when it is purposed that both these operations should be performed. It will at once appear obvious, he thinks, that either of these last-mentioned methods are preferable to sowing the seed broad-cast, as an opportunity is not only afforded of cleaning the ground properly, but a more abundant return, and grain of superior quality, are also hereby insured.

The spring seed-time in general commences with the sowing of beans. In the southern districts, beans are sown in ordinary seasons so early as the middle or towards the end of February; and, in the northern parts of Scotland, so late as the beginning of April. The month of March may, however, be considered as the general bean-seed season.

But Mr. Young thinks, that "a farmer should begin to sow his bean-crop in February, and, if the soil and the season agree, finish it, if possible; for later sown crops will not succeed so well. The land ought to have been ploughed into three-feet ridges, and well water-furrowed the autumn before; by which means his only object now will be dibbling in the seed: so that the first dry season may be taken. To get the bean-crop in the land at this period is an object of consequence, if the soil is dry enough."

The same writer remarks, in the Survey of Suffolk, that it is there uncommon to give more than one earth for beans, and generally improper, as they love a whole firm furrow, and never thrive better than on a layer.

The author of the Synopsis of Husbandry observes, that there are many different methods of raising a crop of beans. In some counties they sow this pulse by broad-cast, which is by no means an eligible way, since much of the seed will be left above ground, and a great part of that which is covered by the harrow will not be healed to a proper depth: many other objections might, he says, be urged against this method of sowing beans at random, whereof it is not one of the least, that such irregularly sown crops are in great danger of being injured by weeds, which cannot so easily be extricated when the beans are sown at random, as when they are planted regularly in drills.

In some districts, as Middlesex, Surrey, &c. the method is, he says, to plant this pulse in rows stricken out by a line, by which a great saving is made in the article of seed, a circumstance which is thought to compensate for the extraordinary charge of this mode of husbandry; and thus far may be fairly acknowledged, that the method of planting beans by the dibbler is greatly to be preferred to that of sowing the seed at random; the œconomy of this agricultural process he thus explains: the rows are marked out one foot asunder, and the seed planted in holes made two inches apart: the lines are stretched across the lands, which are formed about six feet over, so that when one row is planted, the sticks to which the line is fastened are moved by a regular measurement to the distance required, and the same method pursued till the field is completed. The usual price for this work is 9*d.* per peck, and the allowance two bushels per acre. Great confidence must necessarily be reposed in the people who transact the business of planting beans by the dibbler, who, if inclined to fraud, have it in their power to deceive their employer by throwing great part of the seed into the hedge, from which their daily profits are considerably enhanced, their own labour spared, and every discovery effectually precluded, till the appearance of the crop, when the frequent chasms in the rows will give sufficient indications of the fraud; and by this time, perhaps, the villanous authors of the mischief may have escaped all possibility of detection, by having conveyed themselves from the scene of their iniquity. Such is the method of planting beans by the dibbler; but the neatest and most expeditious way of sowing this pulse, especially the field-bean, is, he observes, that pursued by the Kentish farmers. The usual course in that county, is to plough up the oat or barley grattens, which are designed for beans, soon after wheat-season

is finished, in which condition the fallows are to lie till towards Candlemas, or later, as the state of the weather or the farmer's occasion may require, and then to strike out the furrows.

About eleven furrows to a rod's breadth is the usual width of setting out the rows, though some prefer a wider space, whilst others strike them still narrower; and this difference in the width of the rows is the cause why the farmers vary so essentially in respect to the quantum of seed to be sown on the same given space of ground; for, whilst some will content themselves with an allowance of two bushels per acre, others will throw on a sack of beans upon the same compass of land. When the furrows are struck at the distance before-mentioned, two bushels and a half of middle-sized tick-beans are sufficient to seed an acre; and, on good land (for, if the ground be not either rich in itself, or rendered fertile by art, it is of little consequence to attempt the cultivation of this grain), a person, in his opinion, stands a much fairer chance for a crop when the beans are thinly planted, than when a more liberal quantity of seed is allowed; for, when beans stand so very thick in the rows, they never pod so kindly as when the stalks are less crowded: and, although the crop of haulm may be more abundant, the increase will not be adequate to the large bulk of straw.

In Suffolk, Mr. Young says, beans have been dibbled by some a row on every flag; by others, on every other flag. He has found it more advantageous to plant in clusters four or five beans in every hole, and eight or nine inches from hole to hole, which admits much better hoeing than when more thickly set. Dibbling, says he, is the best and most effective method of cultivating beans.

Mr. Banister further observes, that in Kent some people make use of a drill-plough at bean-seed time; but as these pulse, especially the large ticks, are very unequal in size, they cannot be let out of the hopper with sufficient regularity; for, by this inequality in size, many yards of ground in the length of a furrow will be left vacant from the casual obstruction of a large bean; and, when this is removed, numbers of a smaller size crowd to the chasm, and shoot out of the hopper for a considerable space, till another large bean intervenes to obstruct the passage; and thus the crop makes a very unsightly appearance in the rows, and at the time of harvest is very unequal, and the injury in large fields not inconsiderable: for, in those parts of the furrows where no beans had been sown, an increase cannot be expected: and those which are huddled together by a quart or more in a spot, will, from the thickness of their growth, in course come to little. Some farmers are so nice as to pick and cull the seed before it goes into the hopper, in order to render the beans more even, and remedy the injury above-mentioned; but this is a very tedious job, and after all, he believes, seldom answers the expense.

The best method of sowing these pulse seems, says he, to be from an instrument called a box, which is held by a man who follows the striking-plough, who, by shaking the box filled with beans, drops them with regularity in the furrow, keeping even pace with the striking-plough; so that with two men, and two or three horses to the striking-plough, a man to box, and a boy and two horses to harrow down the ground after the plough, three acres may be finished off in a day, and the whole conducted with regularity.

And, in regard to the methods of sowing, Mr. Young also says, there are many. "Some farmers sow the beans over the land, and plough them in; others plough first, and harrow in the seed; and these both on ridge and flat work. A better way of sowing is, he thinks, either to half plough the ridges, sow broad-cast, and afterwards finish; or to sprain them by hand before the plough, so that they may rise in rows, on the tops of the ridges. In the latter way, they are in single rows, but in the former double. In the following summer, the single rows are ploughed between, in the horse-hoeing manner, and the double ones hand-hoed. Both methods are common husbandry in several parts of the kingdom. But he recommends, in preference to them, other methods, and using a drill-plough, as it executes that work with much greater accuracy than any hand can do. Light drills may be had to wheel along the ground, like a wheel-barrow. The use of such an instrument will, he thinks, save money, at the same time that it performs the work much better. A farmer who has land proper for beans, should, on no account, avoid giving a particular attention to that crop; for it will prove one of his surest funds of profit. By means of beans, he may be able to lessen, if not to banish, the custom of fallowing; for a crop of beans, rising in single rows on three-feet ridges, or double rows at one foot, on four-feet ridges, gives so good an opportunity for ploughing the intervals, and also admits hand-hoeing the rows, that the land may be cleaned as well as by a fallow, and the crop succeeded by corn. But, if the soil be in such order that this culture is insufficient to clean it, then a second crop of drilled beans should succeed, which will be very profitable husbandry, and cannot fail of bringing the land into order. Whenever beans are cultivated with this view of substituting them in the room of a fallow, the farmer should absolutely determine to drill or dibble them, so as to admit the plough between the rows; for no hand-work will clean and pulverize the land sufficiently for this purpose, at least without an expense too great for the object. If the spirited husbandman calculates the expense of a summer-fallow, and also the account of a drilled bean-crop, he will find the necessity of this culture."

He advises "the farmer to remember the general maxim, if he ploughs for beans in February, never to allow his ploughs to stir while the land is wet; if his horses poach at all, or his ploughs do not go clean through the land, he will lose, or greatly damage his crop. But improvements, and especially those which have taken place in Middlesex, but most of all in Suffolk, have opened a new field for this cultivation. The grand basis of which is, to banish spring ploughings, by laying the land ready in autumn, for either dibbling or drilling, in the manner described above."

It is farther remarked, that "the barley-stubbles intended for beans, or land whereon clover failed, having been ploughed into the proper stitches, and

laid dry for winter, as directed above, are now ready for drilling or dibbling. It will probably be the end of the month before the season is suitable for this work. The same attention must be paid to this crop, as to barley, in respect of avoiding spring ploughings, and also to effect every operation without permitting the horses to set a foot on the land. They are ever to move, in spring, only in the furrows. It will now be proper for the farmer to consider, whether he shall adopt the system of drilling or of dibbling, setting, or planting, as the operation is in different districts differently termed." He considers "dibbling as an excellent method, when well performed; but the grand objection to it is the difficulty of getting it well done. When it becomes the common husbandry of a district, the workmen find that great earnings are to be made by it; and this is much too apt to make them careless, and eager to earn still more; and if a very minute attention be not paid to them, by the constant attendance of the farmer, they strike the holes so shallow, that the first peck of a rook's bill takes the seed, and acres may be destroyed, if the breed of those birds be encouraged. Boys are employed for weeks together to keep the fields, but all works that depend on boys are horribly neglected, and thus the farmer suffers materially; but if the seed is deposited two and a half, or (better) three inches deep, it is not so easily got at. The imperfect delivery of beans by all the drill-machines which he has seen, causing many gaps in the rows, is an additional motive to dibble. But, on the contrary, the power to put in the seed at the desired depth, with the drill, is a great motive to use it; nor should the difference of the expense be forgotten. To dibble beans well, at eighteen inches equi-distant, will cost 5*s.* an acre; but drilling will not come to the half of that sum. On layers, whether of grass or clover, he prefers dibbling, because, on such, it is easier to deposit the seed at a safe depth by the dibble, than by the drill, unless it be on clover of one year, ploughed with Mr. Duckett's skim-coulter before winter, and left for frosts to work upon. On such, the drill will work well. This is, however, a point that must be left in some degree of latitude. No general rule can, he says, safely be laid down: the farmer must judge according to soil, season, his dependance on dibblers, and other circumstances: both methods, when well applied, are good. The dibbled crops demand harrowing with fine, light, short-toothed harrows, which will not displace the seed, and it should be carefully done, in order to hide the holes from rooks. The drilled crops want only one light harrowing, to smooth the land." It is added, that, "in putting in beans after barley or wheat, on land ploughed in autumn, the farmer must remember, that if the frosts have had full play, the surface will probably be in such friable order, in a dry February, that he must drill, as the mould would run in, and fill the holes before the seed is dropped. This is a circumstance that will sufficiently explain itself." He further states, that "there is a practice about Coggeshall, in Essex, of having fallow clover, wheat fallow, barley, beans, wheat."

It is observed, that "beans are drilled from twelve to twenty-four inches, equi-distant. In Suffolk, by many farmers, at twelve inches: but, on good land, they will then be evidently too thick, and draw themselves up, without podding below. Eighteen is a better distance, and used by the best farmers. In Kent, fourteen and sixteen inches is the distance adopted by many. In Essex, he has met with double rows at nine, with intervals of twenty-seven inches. He has had great products on layers, from double rows, at nine, with intervals of eighteen, and also twenty-seven, that is, two flags planted and two or three missed, for intervals; the former, viz. the double rows, with intervals of nine and eighteen inches, have, he thinks, been most productive. But this point will entirely depend on the fertility of the soil; for in proportion as the land is rich, whether from nature or from manuring, the distance should be large." It is further remarked, that "in Berkshire, they have a custom, which, in this respect, varies from all other countries with which he is acquainted: it is, to plant in clusters four or five beans in a hole, and nine inches from hole to hole; the space between the rows varied according to soil. Their crops are large. This method admits effective hand-hoeing in the rows, and the intervals are horse-hoed. It may, he says, be combined with *de Chateauxvieux* well-known experiment on planting barley in clusters, which seems to have been very carefully made, and in which four, five, or six grains in a hole, produced more than the same number of grains singly, in as many holes as grains. It is in vain, Mr. Young thinks, to reason about such results; but it appears as if the germination of the grains, in such close contact, caused a fermentation in the soil around, that was beneficial, even in the produce at harvest. In the case of the Berkshire beans, something is certainly to be attributed to the hoeing being more effective than in common rows in other cases."

It is observed, by the same author, that "the quantity of seed will depend much on the distance at which the crop is drilled or dibbled. It takes about two bushels of horse-beans to an acre, the rows equi-distant at eighteen inches; and it demands six bushels of Windsors, put in in the same manner.—The quantity of seed proper for other varieties, will necessarily be in proportion to the size of the grain; and the variation of distance in the rows, will demand seed in proportion to these quantities for the distance named. It is, in almost every case, better, he thinks, to put in a peck too much than half a peck too little."

Mr. Middleton also thinks, as has been observed, that beans should be manured for, and kept perfectly clean while growing, by ploughing, horse or hand-hoeing, and hand-weeding; and that where they are so managed, they are an excellent preparation for either wheat or oats.

They have a tap root, and hence they are more likely to succeed after crops that have fibrous roots; though he never heard that they would not grow after any crop. They are generally sown after such crops as have been mentioned, and ought to be planted on ridgelets, especially on thin-skinned soils.

Mr. Banister recommends it as a good method to roll and harrow beans in the latter end of March. By the roll, says he, the clods are broken so as to afford fresh nourishment to the roots, and the harrows following this operation pulverize and loosen the surface,

which had been flattened and baked down by the rains in the preceding month, by which the beans are considerably assisted in the future progress of their growth. Soon after this the crop should be edge-hoed, and afterwards braked; which method of braking is a piece of husbandry peculiar to this county, and in every respect claims the preference to that of hoeing the whole space between the rows; not only that the braking is performed at an inferior expense, but it is likewise more efficacious, as well for extirpating the weeds that may have sprung up between the rows, as in furthering the advances of the beans in growth, by loosening the soil, and conveying fresh earth to the stalks. This operation of braking may be continued at the interval of three weeks or a month, from the beginning of May till the crop becomes in bloom. When it is proposed to earth up the beans, this may be effected with great facility, by fixing a small block of wood on the strig of the brake, the manner of doing which is familiar to every Kentish ploughman; and, according to the diameter of this block, the earth may be thrown to different heights on the bean-stalks, as they advance in growth.

It is suggested, that in May the rows of beans will demand great attention during the whole month: the shims must work the intervals well, and the rows must be hand-hoed and weeded; at this time the plants are not advanced enough to offer any difficulties, and all operations may, consequently, be performed effectually. If it is a wet season, interruptions will happen, for all hoeing is then very badly done, but no dry time should be lost; it may, from succeeding bad weather, be invaluable. And in the following month they should be horse-hoed once at least, and where they have received a hoeing in the preceding month, this should reverse it, throwing the earth back again to the rows, and putting the ridge in the middle of the interval.

And in July the horse-hoed crops of beans must be attended to very carefully; and as they are now high, if a horse-hoeing is given, it must be very carefully performed. Whether the shim or double mould-board plough be used, Mr. Young says it must be drawn by a whipple-tree as short as permits the horse to work, and hung on to a springing fixture at the beam-end, in the form represented in the annexed plate, by which means the whipple is raised so that if it does brush the beans, it is so high in the stalk, that they bend easily to it without suffering damage; but the higher it is thus raised, the better. Mr. Young has seen them work in Kent, where men from other counties thought it impossible. In this state of the crops, the block of the shim is in a position longitudinal with the rows, otherwise the ends may break the stalks. In common, however, the only horse-work wanting this month is earthing up. Weeds are never to be left, the hands and hand-hoes are ever to attack them;" so that they may be completely destroyed.

In dry summers, when easterly winds prevail, beans are very apt to be stricken with the dolphin, an insect which, in a very short space of time, will destroy the produce of a whole field. In this case, it has been found very beneficial to take off the tops with the scythe, as the dolphin generally effects its first lodgement in the upper part of the stalk.

Where this pulse is sown broad-cast, there remains no other way of cleansing the field, than by cutting up the weeds with a hook, or by turning in a flock of sheep in May, where the ground is very foul, as this animal will devour the weeds, and leave the beans untouched. From this very partial method of weeding, it may fairly be concluded little benefit can accrue, and that the gratten will be abundantly stocked with weeds at harvest, and the ground be totally unfit for sowing with wheat. And indeed the practice of sowing bean-grattens with wheat is never attempted in those countries where this method of sowing beans at random prevails, and here therefore the bean and pea grattens generally come in course the next year for a fallow.

Mr. Middleton observes, that beans are seldom ripe enough to cut till the latter end of August, and the proper time is when the kids are turning black, about ten days before they would begin to open at the ends. Though in some parts of the field the kids may not be so black as in others, this should not prevent their being cut; for they will ripen and harden after that is done, by setting the sheaves upright, and leaving them in the field for a week or ten days. If they are cut long before they are ripe, they will shrink and shrivel; and, if too ripe, they will shed considerably; though there is much less danger in reaping them too early than in letting them stand too long. Those that are over-ripe should be cut with the dew on them, and carried to the barn in the same state, and the green parts of the crop should be cut in the middle of the day.

When the intention is to sow wheat or tares after beans, they ought to be set up so as to occupy as little space as possible, that the vacant ground may be immediately prepared for the next crop.

And Mr. Banister asserts, that after a growing summer, and on land which is in good heart, there will be many green pods, when the crop is upon the whole fit for the hook; for, the stalks having run to a great length, and being very replete with moisture, the upper part of the leaves, pods and stalk, will appear to be in a growing state long after the pods on the lower part of the stalk are fully ripened: to wait the ripening of these upper pods would be very ill-judged, as by this delay great part of the crop would be lost, from the shedding of those which were already come to maturity. The best method, therefore, is to cut the beans when the major part have ripened, and by suffering the shocks to remain some time in the field, the upper parts of the stalks will be sufficiently withered, so as to prevent any ill effects from their humidity, when laid in the barn or stack; nor will the beans from those unripened pods be of any injury to the sample.

At harvest-time, the same author informs us, that in Kent those beans which were sown broad-cast are mown with a scythe, and carried loose into the barn, a practice which is fraught with many inconveniences; but that in Middlesex, where the beans are planted in rows with a dibble as before-mentioned, the intervals

are carefully cleansed during their growth by means of the hoe; and for this purpose the farmers are under the necessity of employing a number of hands, the Kentish method of cleansing the intervals by the brake not having yet been introduced into that county, since the whole ground between the rows must be flat-hoed. At harvest, the stalks are cut with a hook, bound into sheaves, and set up four together; and as a substitute for strings, it is usual to sow the head-lands with peas, the haulm of which answers the purpose of bands to tie up the sheaves. The Kentish mode of husbandry is greatly to be preferred, he thinks, to that of the Middlesex farmers, as is evident from the consideration of the comparative disadvantages which attend a crop raised and managed according to the latter method, with the superior benefits of the former. At seed-time, the planting by a dibbler is infinitely more tedious and expensive than that of dropping the seed into the furrow after the striking-plough; and, in the course of husbandry required to cleanse the intervals, the several flat hoeings cause a far heavier charge than what attends the braking and edge-hoeing; and, after all, the ground is not so well prepared for a wheat-season at Michaelmas, a method of husbandry generally pursued by the Middlesex farmers. One reason may be assigned, he says, why the Kentish husbandry hath not yet been adopted by the Middlesex farmers; and this is from the nature of the land in that county, which in many parts is a deep heavy clay, so that on these adhesive soils the swing-plough is generally used, and the ground divided into partitions, or (as they are termed) lands, to guard against the contingency of a wet season. But surely, says he, this soil might be worked with a turn-rest-foot plough, and by proper drains be secured from the ill effects of a moist time; and the field being thus laid on a level, the rows might easily be struck out, and the subsequent brakings be executed to advantage during the summer, as usual with the Kentish farmers.

It is added, that in those parts of Kent where the round tilth husbandry is pursued, the farmers are particularly attentive to the several operations of hoeing and braking the ground during the growth of the beans; for, as the land in that county is of a nature so fertile as not to require the intervention of a summer-fallow, they spare no pains in the cultivation of their bean and pea-ground, in order to render it as clean and well pulverized as possible by means of the hoe and brake, so that this latter instrument is scarcely ever out of the field, from the beginning of May till the time when the beans are advanced to that height as to obstruct the working of it; by which the ground becomes so intimately divided, that every particle of soil in the interspaces is exposed to the beneficial influence of the sun and air, and, at harvest, scarcely a weed is perceptible throughout the crop. In order to destroy what few weeds may remain in the rows, and to give that part of the ground its due share of pulverization, and to cleanse it from the bean-haulm, a plough is set to work soon after harvest, to spuddle the gratten; and for this purpose a plate of iron is fixed across the share at about four or five inches from the point, and the same axletree and wheels are made use of that were before employed for striking out the furrows; and with this plough and two horses, three acres of ground may be spuddled in a day, by setting the share point in the interval, so that the iron or fin may embrace a row each side; and when the whole field is thus spuddled, the harrows and roll are to succeed, by which the haulm and weeds will be completely extricated at a trifling charge, and the ground be laid in readiness for ploughing the seed-furrows, at which time those beans or peas which may have been shed will have vegetated, and are destroyed by the plough; so that the farmer may, from this mode of husbandry, be not less confident of growing a clean sample of wheat, than if his ground had been summer-fallowed.

On thin, chalky or gravelly grounds, notwithstanding what has been just urged of the good effects of spuddling, he observes that it would perhaps be more prudent to omit that work, lest it might contribute towards loosening the soil beyond a due medium; for on these soils the chief aim should be to close them as much as possible, that at wheat-seed time the surface may be perfectly tight; and therefore to roll and harrow the bean and pea-ground on such soils, in order to rid the field of the haulm, &c. and when it has lain some time, to plough the seed-furrows, is the whole process necessary to prepare it for the succeeding crop of wheat: and this shews, he thinks, the necessity of sowing with this grain or with peas that part of the farm which is most free from weeds, and in the best heart, not only that these pulse do both of them (especially beans) require to be sown on good land, or on such which has been improved by art, but likewise that the grattens may be so perfectly clean, as not to require the operation of spuddling.

It is stated by Mr. Young, that this sort of crop is always reaped and bound in sheaves as wheat, and that from their being late in harvest and extremely succulent, they require being left a good while in the field, and for the same reason should be tied in small sheaves. In binding, there are various methods employed, in some places, the bands are made of wheat-straw; in others of yarn-twine, which will last two years, where the threshers are careful in saving them. Mr. Sherif thinks that this sort of crop should be cut as soon as the eyes have attained their deepest dye, and be immediately sheaved in sheaves of not more than eight or nine inches in diameter. By this practice, both the beans and straw will be better. And Mr. Curwen found that beans might be cut much sooner than was usual.

In Kent they cut their beans with a hook, and bind them into sheaves with rope-yarns. These sheaves are set up in shocks of various forms, either five on each side, in the manner of wheat-shocks, or in a circular form four sheaves to the shock. The expense of cutting, binding, and setting up is from 4s. to 6s. or 7s. per acre, according to the degree of goodness in the crop. Some farmers, in such years when the hops have failed, cut up the bind, and reserve it as a substitute for rope-yarns to tie their bean-sheaves. But though this practice may at first sight bear the appearance of frugality, it will be found eventually to be the most expensive; as the cutting the hop-vines at that season will be apt to cause them to bleed, to the infinite prejudice of the stock; and thus the future crops may be hazarded by a premature removal of

the bind in those years, when, from the failure of the hops, it should seem to be of no further use.

Mr. Marshall, however, recommends the pulling beans in preference to cutting, for, he says, the benefit the soil receives will more than pay for the extra labour in clearing. Another advantage arising from their being pulled, is the stubbornness of the roots keeping the mow open, and admitting a circulation of air. And he says, in another place, that by experience he found pulling up by hand far preferable to cutting with sickles; as they may be pulled up not only much faster, but much cleaner from weeds and grass than when cut, besides leaving the land in a state greatly superior. The waste is also less, so much so as to lose scarcely a bean; and the bean-stalks are immediately ready to bind and set up; and by the roots lifting them from the ground, gives the air a free circulation. The work is also easier to the labourer, who stands more upright, and the power required is much less, especially in dry weather. By striking the roots of each handful against the foot, the mould is almost wholly disengaged from the fibres. The soil in the drills, instead of being bound by the roots, and cumbered by the stubble, is left as loose as a garden, and the surface free from obstructions; and, if thoroughly hoed, is as fit as a fallow to be sowed with wheat on one ploughing. This sort of crop however succeeds well in the stack.

Beans are every where an uncertain crop, consequently the average produce difficult to estimate. In Kent, Mr. Young thinks, they probably exceed four quarters; but in Suffolk, he should not estimate them at more than three: yet five or six are not uncommon.

Mr. Donaldson says, that a crop of beans, taking the island at large, may be supposed to vary from sixteen to forty bushels, but that a good average crop cannot be reckoned to exceed twenty.

In Middlesex, Mr. Middleton tells us, that bean-crops vary from ten to eighty bushels per acre. They are rendered a very precarious crop by the ravages of myriads of small black insects of the same species. The lady-birds are supposed either to generate or feed on them, as they are observed to be much among them. Mr. Foot says, the average produce is from three and a half to four quarters per acre.

Mr. Banister remarks that bean-straw, if well harvested, forms a very hearty and nutritious diet for cattle in the winter-time, and that both oxen and horses, when not worked, will thrive on it. Sheep are also very fond of browsing on the pods, and the cavings are a very nutritious manger-meat for horses. But in Middlesex the straw is generally employed in bedding the farmer's horses and other cattle, and in littering the farm-yards, where it is picked over by young stock; though sometimes a load is sold for 20s. or 25s. delivered in.

When bean-straw and the caving-chaff are made use of as a fodder for cattle, they should always be newly threshed, as in that state they are much more nutritious than when they have been kept some length of time.

Crops of this kind are for the most part applied to the purpose of feeding horses, hogs, and other domestic animals. In the county of Middlesex, all are given to horses, except what are preserved for seed, and such as are podded while green, and sent to the London markets. When pigs are fed with beans, it is observed that the meat becomes so hard as to make very ordinary pork, but good bacon. It is also supposed that the mealmen grind many horse-beans among wheat to be manufactured into bread.

And Dr. Darwin remarks, in his Phytologia, that a strike or bushel of oats weighs perhaps forty pounds, and a strike or bushel of peas and beans perhaps sixty pounds; and as the skin of peas and beans is much less in quantity than that of oats, he supposes there may be at least fifteen pounds of flour more in a strike of peas and beans than in a strike of oats. There is also reason to believe, he says, that the flour of beans is more nutritive than that of oats, as appears in the fattening of hogs; whence, according to the respective prices of these two articles, he suspects that peas and beans generally supply a cheaper provender for horses than oats, as well as for other domestic animals.

But, as the flour of peas and beans is more oily, he believes, than that of oats, it may in general be somewhat more difficult of digestion; hence, when a horse has taken a stomach-full of peas and beans alone, he may be less active for an hour or two, as his strength will be more employed in the digestion of them than when he has taken a stomach-full of oats. According to the experiment of a German physician, who gave to two dogs, which had been kept a day fasting, a large quantity of flesh food; and then taking one of them into the fields, hunted him with great activity for three or four hours, and left the other by the fire. An emetic was then given to each of them, and the food of the sleeping dog was found perfectly digested, whilst that of the hunted one had undergone but little alteration.

Hence it may, he says, be found advisable to mix bran of wheat with the peas and beans, a food of less nutriment but of easier digestion; or to let the horses eat before or after them the coarse tussocks of sour grass, which remain in moist pastures in the winter; or, lastly, to mix finely-cut straw with them.

And it is observed in the fifth volume of the Bath Papers, that it has been found by repeated experience, that beans are a much more hearty and profitable food for horses than oats. Being out of old oats the two last springs, the writer substituted horse-beans in their stead. In the room of a sack of oats with chaff, he ordered them a bushel of beans with chaff, to serve the same time. It very soon appeared the beans were superior to the oats, from the life, spirit, and sleekness of the horses.

It is remarked by the author of the Farmer's Calendar, that some experiments were made by an ingenious gentleman, in sowing this sort of crop for stall-feeding bullocks, while podded but yet green; but that he was not able to ascertain how it answered. The attention of the farmer has however been again called to this scheme by another similar trial, for the use of hogs, by Mr. Cross, which has been published by Dr. Hunter. Of course, he thinks, the circumstances merit attention. "He drilled garden-beans always at three feet, and afterwards turnips in the intervals.

When the beans began to lose their flowers, and to shew a disposition to pod, they were drawn by hand, and given to thirty-eight pigs, ten weeks old, well littered with straw. These were bought the 18th of May, and were kept on clover till the beans were ready. The beans being consumed, the pigs were sold the 18th of September for 40l. beyond the prime cost, and they made forty loads of rich manure. They consumed four acres of beans. To persons who make it a point of using hogs as the means of raising large quantities of manure (and there is no more effective way of doing it), these hints, he thinks, may be very valuable. Beans used for this purpose may be off the land very early, probably much earlier than these were, and in time for putting in another crop immediately, either late turnips or cole-seed, and the land cannot be in the least exhausted. With this view, it is suggested, that there should be a succession of plantings in February, March, and April." In this practice the crop is consumed to great advantage, as the whole of the stems are consumed, and on a small trial we found the hogs to thrive upon them in a remarkable manner. This kind of crop is well adapted to new broken up lays, especially where they have been long in the state of sward, and where it is hazardous to sow them with oats.

Horse-Bean, a small kind of bean principally grown in the field, and cultivated by means of the plough. This sort of bean is much employed in the feeding of horses, and other domestic animals. See *Beans*.

Purple-Bean, a sort of small bean, said to have been originally brought from the Cape of Good Hope, but now used in some districts as a field-bean with great advantage. In an experiment made by Mr Marshall, in respect to the productiveness of this bean, it was found that one stem contained upwards of ninety pods, but some of them were not filled,

2 of which had	5 beans each	-	10 beans.
12	- -	4	- -	48
37	- -	3	- -	111
27	- -	2	- -	54
7	- -	1	- -	7
85				230

The beans of the different numbers were put separately in papers, in order to determine whether the seed which proceeds from the root was specially fructuous, or not in itself peculiarly productive, and whether the particular circumstances of its production influenced its produce. These different parcels of beans were afterwards drilled indiscriminately in a patch of the same kind of land, and the produce of the pods of the different numbers carefully identified by labelled stumps, the experiment being attended to with great care; but, at harvest-time, not the smallest difference could be discovered; the bean brought forth singly, being equally prolific with that which brought forth a pod of four or five.

Tick-Bean, a kind of bean somewhat larger than the horse-bean, which is much grown in the field in some districts. This sort of bean is not, however, so much esteemed for the feeding of horses as the common horse-bean. See *Beans*.

It is the practice in some districts to plough two furrows on each outside of the lands, without sowing any beans in them; and afterwards to drill, with the instrument described below, the three next furrows: then to plough two furrows more without drilling any beans in them, and so on, sowing three, and leaving two for intervals, till the land is finished.

When the beans are about two or three inches high, it is usual in some places to plough two furrows up each interval, turning them from the beans, so as to make a ridge in the middle of each interval. For this use, it is necessary to have a small plough on purpose, about half the size of a common plough, which may be drawn by one horse. This kind of work should be done after rain, if possible. In such kind of weather, the intervals should be repeatedly harrowed with the triangular harrow described below. In performing this business, it is best to go up the interval that was gone down before, and down that which was gone up. This is called cross-tining, by which the land is laid quite smooth, kept clear from weeds, and the beans have a fine loose mould to strike their fibres into; and besides it is a cheap way of weeding this sort of crop.

Bean-*Drill*, a drill calculated for putting this sort of crop into the ground. It is in use in some of the northern districts. It is represented at *fig.* 1. *pl.* VIII. the proportions of which are as follow:

Diameter of the iron wheel, twenty inches; length of the box from *a* to *b*, twenty inches; breadth of the box from *b* to *c*, ten inches; depth of the box from *c* to *d*, five inches and a half; diameter of the cylinder of wood upon the iron axis of the wheel, four inches. This cylinder turns out the beans regularly. Length of the cylinder two inches and a half. On this cylinder are twenty-one holes, a quarter of an inch deep, and half an inch in diameter. *e* is a tongue, which drops upon the cylinder, and plays up easily: the tongue is half an inch thick, and three-quarters wide. When a larger bean than ordinary comes, it will throw the tongue up, which naturally recovers its place again; and so the work goes on well and even. The tongue is represented separately with its notch at *e*: the notch does not go quite through it; it falls exactly on the holes of the cylinder. A lid takes off to put the beans into the box, and buttons down at *f*.

Bean *Drill-plough*, a plough of the drill-kind, invented by Mr. Amos for the purpose of drilling beans. It has the power of delivering the beans in a different manner to most others, as it scatters them on the slice of the preceding furrow, while they in general drop them into the furrow. It has been in much use by the inventor; and on wet lands, in Mr. Young's opinion, must be highly advantageous in depositing the seed while the land is ploughing, and in that way preventing the necessity of going a second time upon it, which is frequently very injurious by the poaching which is produced.—It is seen at *fig.* 2, *pl.* VIII.

Bean-*Harrow*, an implement used for harrowing bean-crops. It is shown in its triangular form in the plate on *harrows*, at *fig.* 5. the proportions of which are, from *a* to *b* eighteen inches; the tines nine inches apart; the three tines in the cross-bar are only three

inches and a half apart. *e*, a cock which plays upon a pin, in which are three holes to hang the whipple-tree in. If it be put into the upper hole, the tines bear very heavy upon the ground; but, if in the lower, they have less hold.

Buck-BEAN, a plant which grows wild in most damp marshy situations. It has three oval leaves standing together upon one pedicle, which issues from the root. Their taste is extremely bitter, and rather nauseous. Dr. Darwin supposes that the leaves of this plant might probably supply the place of hops in the breweries of malt-liquors; and, as it might be plentifully cultivated on boggy grounds, which are not at present used for other purposes, might be a cheaper bitter to the consumer, and save to the public much more fertile soil for the cultivation of corn or other valuable vegetables: It is sometimes called *Bog-bean.*

BEAR, a species of barley, called also winter barley, square barley, and big. It is sometimes written *Bere.*

This grain is chiefly cultivated in Scotland, the northern parts of England, and Ireland. It yields a very large return, but is not esteemed so good for malting as the common barley, for which reason it is very little cultivated in the southern parts of England. See *Barley.*

BEARD, the same with awn. See *Awn.*

BEARD *of a Horse*, the hairs scattered on the under-lip, or the place where the curb of the bridle rests, are sometimes thus denominated.

BEARDED OAT-GRASS, the same with wild oats. See *Wild Oats.*

BEAST, a term generally applied to all such quadrupeds, or four-footed animals, as are made use of for food, or employed in labour; but farmers apply the term more particularly to neat cattle.

BEASTS *of Burthen*, a term applied to such as are employed in labour. See *Oxen* and *Horses.*

BEAT, the surface material, such as roots, soil, &c. which are subject to the operation of barn-beating. See *Pairing* and *Burning.*

BEATERS are such parts of mills or machines as beat against substances introduced into them; thus, those parts of threshing-machines which strike out the grain are denominated beaters.

BEATING *Axe*, an implement formerly employed in the operation of pairing and burning.

BEATING *Flax or Hemp*, an operation in the dressing of these articles, by which they are rendered more soft and pliant. See *Hemp* and *Flax.*

BED, a name given by some writers on drill-husbandry to the spaces occupied by the rows of corn; to distinguish them from the intervals, or open spaces between the beds, which they term alleys. See *Alley.*

BEDDING, a term applied to the straw or other litter used for strawing or covering the stalls or yards where cattle are kept. Barley or oat-straw does very well for all sorts of neat cattle; but wheat-straw is best for horses. See *Litter.*

BEDSTRAW *Ladies*, a weed very common in moist meadows and pasture-grounds. Its slender stalks rise to about a foot in height. The leaves come out in whorls, eight or nine together. They are long, narrow, and of a green colour. Two little branches generally come out near the top of the stalk, supporting a considerable number of small yellow flowers, consisting of one petal, divided into four parts, and succeeded by two large kidney-shaped seeds. It is sometimes termed *cheese-rennet*, and *maid's hair*, or *petty mugwort.* See *Weeds.*

The flowers of this plant are said to coagulate boiling milk, and that the better sorts of Cheshire cheese are sometimes prepared with them.

BEE, a small well-known insect, highly celebrated for its industry. There are several species of this insect, but the *mellifica* or *honey-bee* is only necessary to be noticed here.

This insect is divided by two ligaments into three parts or portions, the head, the breast, and the belly, and it is furnished with downy hairs, is of a dusky colour on the breast, and brownish on the belly. The head is armed with two jaws and a trunk; the former of which play by opening and shutting to the right and left. The trunk is long and taper, and, at the same time, extremely pliant and flexible, being destined by nature for the insect to probe to the bottom of the flowers through all the impediments of their chives and foliage, and drain them of their treasured sweets: but were this trunk to be always extended, it would prove incommodious, and be liable to be injured by a thousand accidents; it is therefore of such a structure, that, after the performance of its necessary functions, it may be contracted, or rather folded up; and besides this, it is fortified against all injuries by four strong scales, two of which closely sheathe it, and the two others, whose cavities and dimensions are larger, encompass the whole. From the middle part or breast of the bee grow the legs, which are six in number. The tibiæ of the hind-legs are ciliated and streaked transversely on the inside; and at the extremity of the feet are two little hooks, discernible by the microscope, which appear like sickles, with their points opposite to each other. In the middle of these hooks there is a little thin appendix, which, on being unfolded, enables the insects to attach themselves to glass and the most polished bodies. This part they likewise employ for transmitting the small particles of crude wax, which they find upon flowers, to a cavity in their thighs. The queen and drones, not collecting wax in this way, are not furnished with this cavity. The wings are four, two greater and two smaller, which not only serve to transport them through the air, but, by the noise they make, to give notice of their departure and arrival, and to animate them mutually to their several labours. The hairs with which the whole body is covered, are of singular use in retaining the fine farina or dust that falls from the chives of the flowers, of which the wax is formed, as will be observed hereafter. The belly of the bee consists of six rings, which slide over one another, and may therefore be lengthened or contracted at pleasure; and the inside of this part of the body contains the intestines, the bag of honey, the bag of poison, and the sting. The office of the intestines is the same as in other animals. The bag of honey is transparent, containing the sweet juices extracted from flowers, which the bee discharges into the cells of the magazine for the support of the community in winter. The bag of poison hangs at the

root of the sting, through the cavity of which, as through a pipe, the bee ejects drops of this venemous liquor into the wound, and so renders the pain more acute. The mechanism of the sting is admirable, being composed of two darts, inclosed within a horny sheath that tapers into a fine point, near which is a slit or opening to let out the poison. The two darts are ejected through one aperture, which, being armed with several sharp beards like those of fish-hooks, are not easily drawn back again by the bee; and indeed she never disengages them if the wounded party happens to start and put her into confusion; but if one can have patience to continue calm and unmoved, she clinches those lateral points round the shaft of the dart, by which means she recovers her weapon, and gives less pain to the person stung. It has been lately asserted, that a person is in less danger of being stung by bees if he keep his mouth shut, the human breath being highly offensive to them. The liquor which at the same time is infused into the wound causes an inflammation and swelling, which frequently continues several days; but may be prevented in some measure by immediately pulling out the sting, and enlarging the puncture, in order to promote a discharge. The poison seems to owe its mischievous effects to certain pungent saline matters; for, if a bee be excited to strike its sting against glass, or any polished surface, a drop of the poison will be discharged and left upon it; which, on being placed under a double microscope, evaporates, and may be seen to concrete and form oblong pointed crystals. Mr. Derham counted on the sting of a wasp eight beards on the side of each dart, resembling the beards of fish-hooks, and the same number may be observed on the darts of the sting of the bee.

Œconomy of Bees.—Hives of bees usually contain fifteen or twenty thousand inhabitants, the knowledge of the nature, generation, and polity of which has been very much promoted by the modern invention of glass-hives, through which all the secrets of the community may be seen by the curious observer. Any person who carefully examines a hive at different seasons of the year, may distinguish three sorts of bees. The first is a large and long-bodied bee, of which there is seldom more than one in a swarm or colony. This is what the ancients called the king, from the respect they always saw paid to it by the other bees; but, being a female, the moderns more properly give it the title of *queen*, or mother of the swarm.

Mr. Keys observes, that on the single female bee, styled *queen*, depend the increase, prosperity, and permanency of a stock. No swarm can possibly be established, unless accompanied by a princess; although the bees become ever so numerous, or eager to swarm. If by any mischance the queen is killed, the bees, soon sensible of her loss, quit the hive to associate with their next neighbours, transferring their treasure with them.

Sometimes, Mr. Wildman says, they consume their own honey, fly about their own and other hives at unusual hours, when other bees are at rest, and pine away, if not soon supplied with another sovereign. Their loss is proclaimed by a clear and uninterrupted humming, which should be a warning to the owner of the bees either to take what honey remains in the hive, or procure them another queen. In this last case the stock instantly revives, and pleasure and activity are apparent throughout the whole hive.

The *queen* being then of such consequence, it is necessary, says Mr. Keys, that the apiator should be able to distinguish her at sight. Observe, therefore, says he, that she is longer and more slender than the *drones*, or the *workers*; her hinder parts tapering to a point: her belly and legs are also yellower; and the upper part of her body much darker than theirs, nearly approaching to a glossy black. The part beyond the wings is divided into four joints, distinguished into so many rings; whereas the *workers* have but three, and those of a lighter colour. The more full of eggs, the more yellow is her belly. Her wings reach only to the third ring, but those of the *workers* extend to the end of their bodies. Her appearance is rather clumsy, but her deportment grave, stately, and calm. She is armed with a sting shorter than those of her subjects. Its use is only to oppose *rival queens*; for otherwise she will bear the roughest handling, without attempting to wound. She is very rarely to be seen, even with boxes of three windows; and, if by chance she is discovered, instantly retires from view. She is represented at *fig.* 12. *pl.* IX.

Her fecundity is amazing; for, in the course of a year, she usually lays forty thousand eggs, or more: she has been seen to lay forty immediately one after another. Her body at the height of the laying season contains some thousands of eggs. If empty cells are not prepared, she is obliged to drop them. She is said to be five times longer in laying a royal egg than a common one. The *eggs* are little white bodies, fixed by their smaller ends to the bottom of the cell. The royal cells are constructed on the edges or sides of the combs, as represented at *fig.* 10. *pl.* IX. sometimes to the number of ten or twelve. These cells, when about half finished, resemble the cup of an inverted acorn, *c*, and are lengthened in proportion to the growth of the maggot or nymph. They hang in a perpendicular manner, with the open end downwards, *c*. After the egg is deposited, it remains in that state three days; and then being hatched, appears as a maggot in the shape of a half moon, lying at the bottom of the cell, surrounded with a clammy white substance, continually supplied by the workers for its nutriment. In five or six days it grows considerably larger, ceases to take food, is then sealed up as at *b*, with a waxen cap, and continues thus about twelve days, when the *royal nymph* bursts open the cover, and issues forth a complete princess. Cold weather makes two or three days difference in the time of exclusion. The queen is impregnated about August, by virtue of which she is enabled to breed in the spring till she produces fresh drones.

Similar to this process is that of the *drones* and *workers*; excepting that the *eggs* are hatched in the common cells, which serve in a double capacity, either for honey or brood. The cells for *drones* are generally in the two middlemost combs of the hive; they are deeper than those for the *workers*, and, when

they happen not to be long enough, are lengthened by a cap of wax, as at *d*. They are generally hatched in twenty-one days.

The second sort of bees are called *drones*, and are the males, and somewhat larger than the workers. They have no sting, or ever stir from the hive, but live upon the honey prepared by the others.

They are, Mr. Keys remarks, those large bees which usually appear before the rising of swarms; and are the only males, and larger than the *workers*; of a clumsy shape, and their extremity large, as are their eyes; their trunk, or proboscis, short and thin, and the body more hairy. They make a much louder and rougher noise than the *workers*; and having no sting, nor instrument to collect honey, are sustained by that of the hive. They are seen at *fig.* 11. *pl.* IX. It seems clear to him, that the drones are of no other use but that of propagation. He has, indeed, often found, that stocks will swarm before any drones appear; yet, perhaps, some were bred long before, residing in the warmest part of the hive: and which facts are true; for drone-nymphs have been cast out in early spring. Soon after honey-gathering ceases, they become devoid of the spermatic milky liquor, and therefore are discarded. The *queen*, containing some thousands of eggs at a time in her body, demands a larger supply of the prolific juice than a few drones are equal to furnish. This accounts for the large number of *drones* found in the hives, as being absolutely necessary. As soon as the *queen* finds no occasion for their service, they separate from the *workers* to the sides of the outward combs. They are little noticed by the *workers*, and if killed at the doors of the hives, they do not resent it. Those that happen to remain in the stocks till the cold weather arrives, soon perish by it.

As their agency in generation, or, indeed, their utility at all, is still disputed by some, it is worth noticing, that they are endowed with a large quantity of a whitish liquor in summer, which the workers are fond of licking when a drone is squeezed. Of the many thousand times Mr. Keys has observed drones in the combs, he never beheld one with its tail in a cell.

Mr. Wildman observes, that the dissection of the drone gives as great a proof of its being the male, as that of the queen does of her being female. In this creature, there is no appearance of ovaries or eggs, nor any thing of the structure of the common working bees, but the whole abdomen is filled with transparent vessels, winding about in various sinuosities, and containing a white or milky fluid. This is plainly analogous to that fluid in the males of other animals, which is destined to render the eggs of the female prolific; and this whole apparatus of vessels, which much resembles the turnings and windings of the seminal vessels in other animals, is plainly intended merely for the preparation and retention of this matter till the period of its being emitted. By pressing the hinder parts, something of a penis may likewise be forced out, which is a small slender fleshy body, contained between two horns of a somewhat harder substance, which join at their base, but gradually diverge as they lengthen. These parts being found in all the drones, and none of them in any other of the bees, seem evidently to prove the difference of sex. If a hive be opened in the beginning of spring, not a single drone is to be found in it; from the latter part of May till the end of June, from 200 to 300, or 1000, are commonly met with; but from this period to the succeeding spring, it is in vain, he says, to look for them.

They venture out about eleven o'clock in the morning, and return before six in the evening; but their expeditions are not those of industry. They have no sting, their rostrum and feet are not adapted for collecting wax or honey, nor are they under the necessity of labouring, their office being to impregnate the eggs of the queen after they are deposited in the cells; and while they are thus necessary, they are suffered to enjoy the pleasures of love and life; but, on their becoming useless in the hive, the working bees declare war and destruction against them. This affects not merely the bees that are already in life, but the eggs and maggots also, the hive being cleared of every egg, maggot, or nymph. After the elapse of the season of increasing the quantities of bees, and when attention is only necessary to the providing of winter-stores, every trace of the drones is removed, in order to make room for honey. When drones are observed to continue in a hive late in the autumn, it is generally supposed to indicate an unfavourable state of it.

Maraldi and Reaumur long since discovered, that, besides the large drones, there were others of a size not much exceeding that of the working bees; and the fact has been more fully ascertained by the late experiments of Mr. Debraw. As bees begin to breed sometimes very early in the spring, when the weather is mild, even in February, and as it has been shown that the large drones do not appear till a much later period, it is probable that a few of those small-sized drones may be suffered to remain, as they consume but little honey at the time it is scarce, for the purpose of supplying the early broods, while the large drones are reserved for a later period, when the honey is in greater plenty. Some assert that the small drones are all dead before the end of May, at which time the large ones appear and supersede their use.

The third sort of bees, which are the far greatest number, are the common *working-bees*, who do all the business of the hive, and seem to be neither male nor female.

The common bees, or *workers*, according to Mr. Keys, live about a year, but are very liable to premature death by hard labour, high winds, birds, and by many other accidents. They are probably of neither sex, but absolutely neuters. The young bees are distinguishable from the old, by being of a lighter brown. They are not all of one size, a few appearing shorter than the others. They are exhibited at *fig.* 13. *pl.* IX.

Their labour seems to be indiscriminate: they build the combs, nurse and sustain the young, collect honey, and defend the hive against all invaders. For cleanliness, they are remarkable; have a quick and extensive smell, either for honey or honey-dew; but are not disgusted with many odours offensive to us, as paint, tar, urine, &c. partaking sometimes of such substances as are pernicious to them. Foreseeing impending storms, they make a precipitate retreat in

great multitudes. When first placed in a hive they work night and day, taking repose by turns, and sleeping in clusters. They can readily distinguish the bees of their own hive from all others; and highly resent the killing, or even disturbing, any bees of the same apiary, with vengeance attacking the aggressor.

The bee has two stomachs, one that contains honey, and another that holds the crude wax. As the organs of the common bees neither resemble those of the queen, nor of the drones, they have commonly, as has been observed, been supposed to be of neither sex; but a very different opinion has been lately maintained, which we shall have reason to notice as we proceed.

The sting is a very necessary part of the œconomy of a working bee, both as an offensive and a defensive weapon: for their honey and wax excite the envy of many greedy and lazy insects; and they have also to defend themselves against enemies, who are fonder of eating them than their honey. There is likewise a time when the drones must be sacrificed and exterminated for the good of the society; and as they are larger and stronger than the working bees, these last would have a very unequal match, were it not for this formidable weapon.

Among bees, either of the same or of different hives, there sometimes arise most deadly feuds, in which great skill may be discerned in their manner of pointing the sting between the scaly rings of their adversaries' bodies, or to some other easily vulnerable part. The bee which first gains the advantage remains the conqueror: though the victory costs the victor his life, if he has left his sting in the body of the enemy; for with the sting, part of his bowels is torn out, and death inevitably follows. Bees have very severe conflicts, when the whole hives engage in a pitched battle, and many are slain on both sides. Their fighting and plundering one another ought chiefly to be imputed, as Mr. Thorley observes, either to their perfect abhorrence of sloth and idleness, or to their insatiable thirst for honey; for when, in spring or autumn, the weather is fair, but no honey can be collected from plants, and is to be found only in the hives of other bees, they will venture their lives to get at their object. Indeed another cause has been assigned for their fighting; which is the necessity that the bees are reduced to when their hive has been plundered, at a season when it is too late for them to repair the loss by any industry in the fields.

It sometimes happens that one of the queens is killed in the battle. In this case, the bees of both hives unite as soon as her death is generally known. All then become one people; the vanquished go off with the robbers, richly laden with their own spoils, and return every day with their new associates to pillage their old habitations. This causes a throng, unusual for the season, at the door of the hive they are plundering; and if the owner lifts it up at night, when all are gone home, he will find it empty of inhabitants; though there perhaps will remain a small quantity of honey in it.

If two swarms happen to take a flight at the same time, they sometimes quarrel till one of the queens is slain. This however ends the contest, and the bees of both sides unite under the surviving queen.

When these insects begin their works, it is observed they divide themselves into four companies, one of which is destined to the fields to provide materials for the structure; the second works upon those materials, and forms them into a rough sketch of the dimensions and partitions of the cells; the third examines and adjusts the angles, removes the superfluous wax, polishes the work, and gives it its necessary perfection; and the fourth is employed in bringing provisions to the labourers that build them, because polishing is not so laborious. They begin their work at the top of the hive, continuing downwards to the bottom, and from one side to the other; and to make it the more solid, they use a sort of tempered wax, resembling glue. The form of the cells of the honey-comb is hexagonal, which, besides the common advantage of the square and equilateral triangle, has the additional one of including a greater space within the same surface. The expedition of bees in their labours is almost incredible; for, notwithstanding the elegance and just proportions of the work, they are so indefatigable, that they will, in one day, finish cells capable of receiving three thousand inhabitants.

It is difficult to know the particular manner in which they employ themselves at this work, on account of the number of bees in motion, by which means little can be distinguished but confusion. It may be observed, however, that some bees, bearing in each of their talons a little piece of wax, are seen running to the places where their companions are at work upon the combs; at their arrival, they fasten the wax to the work by means of the same talons, which they apply sometimes to the right, and sometimes to the left. Each bee is employed but a short time on this work, when another takes its place.

While a part of the bees are engaged in constructing the cells, others are employed in perfecting those that are newly modelled, finishing the angles, sides, and bases in so exquisite a manner, and with such remarkable delicacy, that three or four of these sides laid upon one another, are not thicker than a leaf of common paper; and because the entrance of the cell, which is adapted to the size of the bee, would, on account of this delicacy, be subject to break, they strengthen the entrance of each cell with a border of wax.

It has been already observed, that the bees which build the cells, work but a little while at a time: but it is different with regard to those that polish them; for they work for a long while, and with great expedition, never intermitting their labour, unless it be to carry out of the cell the particles of wax taken off in polishing: and, to prevent the wax from being lost, other bees standing ready to receive it from the polishers, and carry it to some other part, in order to its being employed.

Each comb has two rows of cells opposite to each other, which have their common bases. The thickness of each comb is something less than an inch; and, consequently, the depth of each cell about five lines: but at the same time the breadth of each is little more than two. All the combs are constructed with cells of this size, except a small number in some particular

parts of the hive, which are larger, and appropriated to the lodging of eggs, that afterwards become drones, or male-bees. There are also, in some parts of the hive, three or four cells bigger than the others, and constructed, as we have seen above, in a different manner, being of a spheroidical figure, open in the inferior part, and attached to the sides of the combs.

When the cells are completed, the queen takes possession of those she likes best, to deposit her eggs in, and the rest are left to be filled with honey. She lays one egg in each cell, and sometimes more than a hundred of those eggs in a day; but what is still more remarkable, she lays those eggs which are to produce common bees, in cells of the common shape and size; those that are to become drones or males, in the cells of a larger size, and deposits those which are to become females, like herself, in the spheroidical cells already described. These eggs, after lying some time in the cells, are hatched into maggots, and fed with honey ten or twelve days, after which the other bees close up the cells with a thin piece of wax; and under this covering they become gradually transformed into bees. Having undergone this change, the young bees pierce through their waxen cases, wipe off the humidity from their little wings, take their flight into the fields, rob the flowers of their sweets, and are perfectly acquainted with every necessary circumstance of their future conduct. As to the males or drones, which are destined only to propagate their species, they live very comfortably for about three months after they are hatched; but when that time is over, and the females are impregnated, the common bees either kill them, or drive them from the hive, as burthensome to the community.

The method in which bees collect their wax and honey, deserves to be explained. At the bottom of most flowers there are certain parts which contain more or less honey, that is, the most refined particles of the sugary juices of the plant. These juices the bee sucks up with her proboscis, or trunk, abovementioned, and draws it into her mouth; and, when she has thus taken a sufficient quantity into her stomach, returns to the hive, and discharges the honey into the common magazine. But, besides this mode of supplying themselves, they have another, which is that of collecting the substance, known by the title of *honey-dew*, from the trees and plants that contain it.

When the cells prepared to receive it are full, the bees close up some with wax till they have occasion for the honey; the rest they leave open, to which all the members of the society resort, and take their repast with a very instructive moderation.

Wax is prepared from the farina, or dust, formed on the apices of flowers. This the bees collect, and with their fore-feet and other parts roll up into little balls, which they convey, one at a time, to the feet of their middle legs, and from thence to the middle joints of their hind legs, where there is a small cavity like a spoon to receive it. These balls are not, however, true wax, but the substance or basis of it; as, in order to reduce it into wax, it must first be digested in the body of the bee. After the bees have brought home this crude substance, they eat it by degrees; or, at other times, three or four bees come and ease the loaded bee, by eating each of them a share, the loaded bee giving them a hint so to do. Hunger is not the motive of their thus eating the balls of waxy matter, especially when a swarm is first hived; but it is their desire to provide a speedy supply of real wax for making their combs. At other times, when there is no immediate want of wax, the bees lay this matter up in repositories, to keep it in store. When this waxy matter is swallowed, it is by the digestive powers of the bee converted into real wax, which the bees again disgorge, as they work it up into combs; for it is only while thus soft and pliant from the stomach, that they can fabricate it properly. That the wax thus employed is taken from their stomachs, appears from their making a considerable quantity of comb soon after they are hived, and even on any tree or shrub where they have rested but a short time before their being hived, though no balls were visible on their legs, excepting those of a few which may be just returned from the field. Bees collect crude wax also for food; for, if this was not the case, there would be no want of wax after the combs are made: but they are observed, even in old hives, to return in great numbers loaded with such matter, which is deposited in particular cells, and is known by the nume of *bee-bread.* We may suppose that they consume a great deal of this substance in food, by the quantity collected, which, by computation, may in some hives amount to a hundred weight in a season, whilst the real wax in such a hive does not perhaps exceed two pounds.

But besides the three substances, honey, wax, and bee-bread, already mentioned, there is another with which the bees close every crevice in their hives, and which is called *propolis.* It is a kind of resin, easy to be rolled out, much more tenacious than wax, and more easily fixed. It does not seem to require any preparation, being a real resin, which they collect from trees, and employ as they find it. It grows very hard in the hive, but may be softened by heat. It is dissoluble in spirit of wine. It commonly diffuses a very agreeable smell when heated. Its outward colour is of a reddish brown; its inside resembles wax, and is a little yellowish. When the bees make use of it, it is soft and pliable; but it hardens daily, and becomes in time harder than wax. This substance serves also for another purpose, which is, that when a snail, slug, or any other creature too large to be carried out by the bees, has been slain in the hive, to case it over with, and thereby prevent the bad effects of the putrid smell arising from the dead body.

The time at which a young queen becomes capable of leading a swarm from the hive in which she was produced, is generally about four or five days after she has appeared in it in a *winged* state.

When a hive is become too much crowded, by the addition of the young brood, a part of the bees think of finding themselves a more commodious habitation, and, with that view, single out the most forward of the young queens. A new swarm is therefore constantly composed of one queen at least, and of several thousand working-bees, as well as of some hundreds of drones. The working-bees are some old, some young.

Scarce has the colony arrived at its new habitation, when the working-bees labour with the utmost dil-

ligence to procure materials for food and building. Their principal aim is not only to have cells in which they may deposit their honey; a stronger motive seems to animate them. They seem to know that their queen is in haste to lay her eggs. Their industry is such, that in twenty-four hours they will have made combs twenty inches long, and wide in proportion. They make more wax during the first fortnight, if the season is favourable, than they do during all the rest of the year. Other bees are at the same time busy in stopping all the holes and crevices they find in their new hive, in order to guard against the entrance of insects which covet their honey, their wax, or themselves: and also to exclude the cold air, for it is indispensably necessary that they be warmly lodged.

When the bees first settle in swarming, indeed when they at any time rest themselves, there is something very particular in their method of taking their repose. It is done by collecting themselves in a heap, and hanging to each other by their feet. They sometimes extend these heaps to a considerable length. It would seem probable, that the bees from which the others hang must have a considerable weight to support. But all that can be said on the subject, is, that the bees must find this to be the situation the most natural and agreeable to them. This situation of these animals is represented in *pl.* IX. *fig.* 8.

When a swarm divides into two or more companies, which settle separately, this division is a sure sign that there are two or more queens among them. One of the clusters is generally larger than the other. The bees of the smaller cluster or clusters detach themselves by little and little, till at last the whole, together with the queen or queens, unite with the larger cluster. As soon as the bees are hived and settled, the supernumerary queen or queens must be sacrificed to the peace and tranquility of the hive. This execution generally raises a considerable commotion in the hive, and several other bees, as well as the queen or queens, lose their lives. Their bodies may frequently be observed on the ground near the hive. The queen that is chosen is mostly of a more red colour than those which are destroyed; so that fruitfulness seems to be a great motive of preference in bees; for the nearer they are to the time of laying their eggs, the larger and more shining are their bodies.

Management of BEES. This is a matter of much importance, and on which the advantage of this kind of stock chiefly depends. The nature and situation of the apiary has been already pointed out. See *Apiary*.

It is well observed, that the owners of bees should be particularly attentive that the bees have in their neighbourhood plenty of such plants as yield them food, as of the tree kind, the oak, the pine, the sweet-smelling cedar, and all fruit trees; as well as furze, broom, mustard, clover, heath, buck-wheat, beans, &c. The plantations of mustard, of the flowers of which bees are extremely fond, may be kept in bloom for several weeks together.

According to Mr. Keys, a plentiful assortment of bee-flowers is a consideration of much importance, where an ample production of honey is the object; and the nearer the pasturage is to the apiary, the more journies the bees can make in a day, and consequently the sooner they are able to fill their hives.

The product, he says, from a large supply, but at a small distance, and in a temperate situation, even with the common management, will be superior to that of the most skilful in a bad one. On the contrary, with bad management, and with scanty pasturage, and indifferent situation, a very trifling profit can be expected. Britain in general is but thinly stocked with bees. Few farmers, in comparison, esteem them worth their notice; it is from the attention of cottagers we derive the chief supply of honey and wax. It will be readily admitted, that a large number of stocks kept within a small circuit, and in a bad situation, will be prejudicial to that circuit, as being more than can be supported in plenty, and will necessarily impoverish each other. The state of any particular situation may be known by the general product for several years together, and not from one or two years only; but more certainly from what a very good season will produce, which may be accounted as a standard. But there are many situations capable of feeding a much larger number of stocks than are to be found on them. However, if the generality of farmers and cottagers individually would keep a few stocks, nearly all the honey and wax this country could produce, might, he thinks, be collected. This would not only benefit individuals, but might also be of real national utility.

Large heaths and commons, surrounded with woods, are noted for being abundantly productive: the first abounding with wild thyme, and various other flowers untouched by the scythe, and the other with a profusion of farina and honey-dews. Heath and broom are very serviceable, as continuing long and late in bloom. It is remarkable that the domestic bees are very nice in their selections, and do not rove from one sort of flowers to those of another, indiscriminately. They are limited to a few kinds. Those of the most gaudy colours, and which afford the most resplendent show and agreeable odours, are mostly neglected by them, as hyacinths, jasmines, roses, honey-suckles, &c. while very small flowers, or those of little note, are to them plentiful sources of nectareous sweets.

He further remarks, that sallows furnish a larger quantity of farina than most other plants, and that as early as the bees have occasion for it. Rosemary is the first aromatic plant that blows; it grows wild in some parts of France, and is the cause of that superiority for which the Narbonne honey is esteemed. Minionette yields good honey, and is valuable for its long continuance in bloom even till November. Beds of it near an apiary will be of advantage, as will edgings of creeping lemon-thyme, along the borders of the garden. Single wall-flowers in plenty, will be serviceable. Lime-trees are not to be neglected about apiaries, serving in a double capacity by their flowers, and their leaves, which are frequently covered with honey-dews. Neither beans nor orchard-trees afford any great quantity of honey; as may be observed by the stocks in Herefordshire, which, though abounding in orchards, is not more productive in honey than other counties. In contrast to this, the borders of Cambridgeshire and Hertfordshire, and part of Hampshire, abounding with large heaths, commons,

and woods, are much more productive than any other parts of the kingdom. Farmers there, have been known to keep from a hundred to a hundred and fifty stocks of bees.

Viper's bugloss is, he says, a plant much like borage. It is a very troublesome weed in corn, among which it is found in many places in great plenty, but it is sure to make rich hives: it has a biennial root, delights in chalky or dry soils, and will grow on old walls. But borage is the king of bee-flowers; it is annual, and blows all the summer, till the frost cuts it off. It affords honey, even in cold and showery weather, when other flowers do not, owing to the flowers being pendulous. The seeds drop and sow themselves: the honey from it is fine.

In order, says he, to find the quality of the honey from any particular species of flowers, if they are in considerable quantity, set small glasses over a stock at the time of their flowering, and they will chiefly be filled with honey of the predominant flavour.

Great improvements may certainly still be made in the essential article of providing plenty of pasture for bees, whenever the subject is carefully attended to. A rich corn country is well known to be a barren desert to them during the most considerable part of the year; and therefore the practice of other nations, in shifting the places of abode of their bees, well deserve our imitation. Columella says, that as few places are so happily situated as to afford the bees proper pasture both in the beginning of the season, and also in the autumn, it was the advice of Celsus, that after the vernal pastures were consumed, the bees should be transported to places abounding with autumnal flowers; as was practised by conveying the bees from Achaia to Attica, from Eubœa and the Cyclad islands, to Scyros, and also into Sicily, where they were brought to Hybla from other parts of the island. He likewise directs, that the hives be carefully examined before they are removed from one place to another, and to take out such combs as appear old, loose, or have moths in them, reserving only those that are sound, in order that the hive may be stored with combs collected from the best flowers.

This was also the practice in Italy, as is evident from the works of the same author. And it is still the practice of the Italians who are stationed on the banks of the Po.

Mr. Maillet, in his curious description of Egypt, relates, that, "in spite of the ignorance and rusticity which have got possession of that country, there yet remain in it several footsteps of the industry and skill of the ancient Egyptians. One of their most admirable contrivances is, their sending their bees annually into distant countries, in order to procure them sustenance there, at a time when they could not find any at home; and afterwards bringing them back, like shepherds who travel with their flocks, and make them feed as they go. It was observed, by the ancient inhabitants of Lower Egypt, that all plants blossomed, and the fruits of the earth ripened above six weeks earlier in Upper Egypt, than with them. They applied this remark to their bees; and the means then made use of by them, to enable these useful insects to reap advantage from the more forward state of nature there, were exactly the same as are now practised for the like purpose in that country. About the end of October, all such inhabitants of the Lower Egypt, as have hives of bees, embark them on the Nile, and convey them upon that river quite into Upper Egypt; observing to time it so that they arrive there just when the inundation is withdrawn, the lands have been sown, and the flowers begun to bud. The hives, thus sent, are marked and numbered by their respective owners, and placed pyramidically, in boats prepared for the purpose. After they have remained some days at their farthest station, and are supposed to have gathered all the wax and honey they could find in the fields, within two or three leagues around, their conductors convey them in the same boats two or three leagues lower down, and there leave the laborious insects such a length of time as is necessary for them to collect all the riches of this spot. Thus, the nearer they come to the place of their more permanent abode, they find the productions of the earth, and the plants which afford them food, forward in proportion. In fine, about the beginning of February, after having travelled through the whole length of Egypt, gathering all the rich produce of the delightful banks of the Nile, they arrive at the mouth of that river towards the ocean; from whence they set out, and from whence they are now returned to their several homes: for care is taken to keep an exact register of every district from whence the hives were sent in the beginning of the season, of their numbers, of the names of the persons who sent them, and likewise of the mark or number of the boat in which they were placed."

Something of the same kind may likewise be frequently seen in France, where they have floating bee-houses. They sometimes pile upon one barge threescore or an hundred bee-hives, which are well defended from the chance of accidental storms. With these the owners suffer themselves to be gently floated down the rivers, the bees having the opportunity of choosing their flowery pasture on the banks as they pass along. They are also frequently transported in carts by land, the hives being carefully piled over each other.

These instances of the advantages which attend shifting of bees in search of pasture, afford an excellent lesson to the inhabitants of many places in this kingdom: they show particularly the inhabitants of the rich vales, where the harvest for bees ends early, the advantage of removing their stocks to places which abound in heath, this plant continuing in bloom during a considerable part of the autumn, and yielding great plenty of food to bees. Those in the neighbourhood of hills and mountains, may save the bees a great deal of labour, by taking also the advantage of shifting their places of abode.

Purchasing Bees.—For this important business Mr. Keys gives the following directions: The best time for establishing an apiary, says he, is just before the taking-up season, which is generally about the latter end of August, for then bee-keepers reserve as many of the best stocks as they judge expedient for their next summer's supply, and, therefore, after that period are not disposed to part with any, unless at an advanced price: whereas, by purchasing some time before, a choice may be made of the best, and at the

accustomed rate. They should be selected by a skilful person, in a cool evening, or rather morning, very early. By tapping about the hive, a pretty near guess may, he says, be formed whether or not it is full of bees, as also if full of combs. But, for greater certainty, turn those that seem heavy upon the edge of the hive, and observe if the interstices between the combs are crowded with bees, and the combs worked down to the floor. If white, or of a light yellow, it denotes their being of the present year's produce, and fit for the purpose; but if they are of a very deep yellow or brown, they are of the last season, and not so proper; while those that are dingy or blackish are old, and wholly unfit to furnish a prosperous apiary. To avoid deception, observe, that though a hive may have the edges of the combs of a light yellow, they may be old stocks nevertheless, whose combs the preceding year not having been completed, have in the present had new borders added to them of virgin-wax, so as to look like young stocks. Look carefully between the combs, as far as the bees will admit: and if the interior parts appear favourable, form a judgment accordingly. The hive should be poized in the hand; and if it be about half-bushel size, and weigh twenty-five pounds or upwards, it is another test of its being a good stock. But the weight alone of old stocks cannot be relied on, as great part of the combs may be crammed with old farina, and other impurities. One good stock bought at the proper time, he observes, is worth two swarms bought in the spring; for such a stock will swarm once or twice, or yield two or three hives full of honey; whereas, from a swarm, little or no profit can be expected the first year. But should the proper season have been neglected, a prime, or first swarm, should be sought, at least large enough, in common situations, to fill a peck; and, if a good one, half a bushel. Small swarms will turn to little account, and baulk the expectation. The swarm is to be brought home in the evening of the day it rises. If a large one cannot be had among the neighbours, two or three may be united, to form a powerful stock. If a swarm is delayed being brought home, for two or three days, portions of combs will have been constructed, which may probably be displaced in the removal, with the bees thereon, and may be damaged or crushed, and so be the ruin of the swarm; to avoid which, let it, says he, be removed at day-break.

To transfer the swarm from the common hive into one of your own, or into a box, invert that which has the swarm, in a pail, bucket, or the like; lay two thin flat sticks across; and then set the empty hive over it; stop the juncture with a cloth, and before morning the bees will have ascended into the upper one. But if not, let them stand a day longer; when, if they still are reluctant, stop the juncture quite, and beat round the lower hive with two small sticks, till they ascend, which may be known by the great buz in the upper hive. Or, as soon as two swarms are brought home, spread a cloth on the ground, and lay a stick across: then strike the edge of the hive with violence on the ground; the bees will fall out in a lump. Then take the other swarm, and serve them in the same manner, close by the first; set an empty hive over them, resting one edge on the stick, and cover them with a cloth. If they are found to quarrel when ascended, they must be fumed as directed hereafter.

Removing of stocks should take place in the evening, or very early in the morning. The hives should be raised by three or four wedges, some hours before, provided the floor is not moveable; or otherwise many bees will remain on the floor at the time, and be very troublesome. A cloth must be laid on the ground behind the hive, to be removed; then nimbly lift the hive thereon, and, gathering the four corners tight, tie them fast on the top: immediately draw a string close round the body of the hive, to prevent any bees crawling between.

If they are to be carried a considerable distance, they may be rested on the ground, as occasion may require. Hand-barrows, or yokes, with a hive suspended at each end, or a long pole on men's shoulders, and a hive or two between, may be advantageously used for their conveyance. But when it is for several miles, a coach, or cart with plenty of straw at the bottom, to break the shocks of the carriage, proceeding with the slowest pace, and taking the cool of the morning, may prove a safe and convenient means of removal. If any of the combs should, however, be broken, and fallen on the cloth, when the hive is taken off, let them remain thereon, and set the hive in the place or stand designed for it; and gently spreading the cloth with the bees on it at the top, by the morning they will have quitted, and entered by the door of the hive. A stock should be set close to the bee-house front, the first night of its being brought home, that the straggling bees may find their way into the hive by the door, and then no bees will be crushed. Straw-hives, being of a circular form, leave a considerable vacancy between the hive-doors and front, which next night must be stopped, by thrusting part of a hay-band, or clay, or stiff cow-dung, to fill the chasms, but leaving the door-way free.

Purchased swarms in spring, on bringing home, are to be immediately set on empty hives; and thus, by being doubled at first, will save that trouble afterwards.

It may be observed, in respect to the age of bees, that the large drones live but a little while, being destroyed without mercy by the working-bees, probably to save honey, as we have already said. But of the other sort lately discovered, no larger than the working-bees, and not easily to be distinguished from them, the age has not yet been ascertained. Writers are not agreed as to the age of the working-bees: some maintain that they are annual, and others suppose that they live many years. Many of them, it is well known, die annually of hard labour: and though they may be preserved by succession in hives or colonies for several years, the most accurate observers are of opinion that their age is but a year, or no more than two summers at the utmost.

The sex and fecundation of bees have been the subjects of various experiments. Of late years, much new light has been thrown upon the subject, and several difficulties which embarrassed the process of generation among these curious insects seem to have been

got the better of. Swammerdam, and after him Miraldi, discovered in the structure of the drones some resemblance to the male organs of generation, as has already been described; and from thence concluded, that they were the males: but neither of those accurate and industrious observers could detect them in the act of copulation. Swammerdam, therefore, entertained a notion, that the female or queen-bee was fecundated without copulation; that it was sufficient for her to be near the males; and that her eggs were impregnated by a kind of vivifying aura, exhaled from the body of the males, and absorbed by the female. However, M. Reaumur thought that he had discovered the actual copulation of the drones with the female bee, and he has very minutely described the process of it. A very ingenious naturalist of the present day, without taking any notice of recent discoveries, seems also to have given into the same idea. "The office of the males or drones," says he, "is, to render the queen pregnant."

But, on the contrary, others, as M. Schirach and M. Hattorff, have denied that drones bear any share at all in the business of propagation, and even assert that the queen-bee is self-prolific. But for what purpose then should wise nature have furnished the drones with that large quantity of seminal liquor? of what use is so large an apparatus of fecundating organs so well described by Reaumur and Miraldi? The fact is, that they have founded their opinion upon observations that hives are peopled at a time of the year when, as they supposed, no drones were in being. But we have already said, that nature has provided drones of different sizes for the purpose of impregnation, adapted to different times, occasions, and circumstances: and the mistake of Messrs. Schirach and Hattorff, seems to have proceeded from their missing the large-sized drones, and not being acquainted with, or not adverting to, the other sort, so difficultly distinguishable from the working-bees.

In fine, many of the ancient, as well as modern writers, have supposed that the eggs of the female-bee are not impregnated with the male sperm while in the body of the animal, but that they are deposited unimpregnated in the cells, and that the male afterwards ejects the male sperm on them as they lie in the cells, in the same manner as the generation of fishes is supposed to be performed by the males impregnating the spawn after it is cast out by the females. M. Miraldi long since conjectured that this might be the case; and he was confirmed in his opinion, by observing a liquid whitish substance surrounding each egg at the bottom of the cell a little while after it had been laid; and that a great number of eggs, which were not encompassed by this liquor, remained barren in the cells. But this method of impregnation has been established beyond all contradiction, by the observations of Mr. Debraw (Philos. Trans. vol. 67. part i. art 5.). Having put some bees into glass-hives with a large number of drones, he observed, on the first or second day (always before the third) from the time in which the eggs were placed in the cells, which the queen generally lays on the fourth or fifth day after they are put into the hive, that a great number of bees fastened themselves to one another, and formed a kind of curtain from the top to the bottom of the hive, probably in order to conceal the process of generation. Mr. Debraw, however, could soon perceive several bees, whose size he was not able to distinguish, inserting the posterior part of their bodies each into a cell, and sinking into it; after a little while they retired, and he could see with the naked eye a small quantity of whitish liquor left in the angle of the base of each cell containing an egg; this liquor was less liquid than honey, and had no sweetness when tasted.

But, with a view of proving further, that the eggs are fecundated by the males, and that their presence is necessary at the time of breeding, Mr. Debraw made a number of experiments. He left in a hive the queen, with only the common or working-bees, without any drones, to see whether the eggs she laid would be prolific. To this end, he took a swarm, and shook all the bees into a tub of water, leaving them there till they were quite senseless; by which means he could distinguish the drones, without any danger of being stung: leaving these out, therefore, he restored the queen and the working-bees to their former state, by spreading them on a brown paper in the sun; after this he replaced them in a glass-hive, where they soon began to work as usual. The queen laid eggs, which, to his great surprise, were impregnated; for he imagined he had separated all the drones or males, and therefore omitted watching them; at the end of twenty days, he found several of his eggs had, in the usual course of changes, produced bees, while some had withered away, and others were covered with honey. Hence he inferred, that some of the males had escaped his notice, and impregnated part of the eggs. To convince himself of this, he took away all the brood-comb that was in the hive, in order to oblige the bees to provide a fresh quantity, being determined to watch narrowly their motions after new eggs should be laid in the cells. On the second day after the eggs were placed in the cells, he perceived the same operation that was mentioned before, namely, that of the bees hanging down in the form of a curtain, while others thrust the posterior part of the body into the cells. He then introduced his hand into the hive, and broke off a piece of the comb, in which there were two of these insects: he found in neither of them any sting, a circumstance peculiar to the drones. Upon dissection, with the assistance of a microscope, he discovered the four cylindrical bodies which contain the glutinous liquor, of a whitish colour, as observed by Miraldi in the large drones. He was therefore now under a necessity of repeating his experiments, in destroying the males, and even those which might be suspected to be males.

He once more immersed the same bees in water; and, when they appeared in a senseless state, he gently pressed every one, in order to distinguish those armed with stings from those which had none, and which of course he supposed to be males: of these last he found fifty-seven, and replaced the swarm in a glass-hive, where they immediately applied again to the work of making cells; and on the fourth or fifth day, very early in the morning, he had the pleasure to see the queen-bee deposit her eggs in those cells:

he continued watching most part of the ensuing days, but could discover nothing of what he had seen in the former case. The eggs, after the fourth day, instead of changing in the manner of caterpillars, were found in the same state they were the first day, except that some were covered with honey. A singular event happened the next day about noon: all the bees left their own hive, and attempted to get into a neighbouring hive, probably in search of males; but the queen was found dead, having been killed in battle.

To be further satisfied, Mr. Debraw took the brood-comb, which had not been impregnated, and divided it into two parts: one he placed under a glass-bell, with honey-comb for the bees' food, taking care to leave a queen, but no drones, among the bees confined in it: the other piece of brood-comb he placed under another glass-bell, with a few drones, a queen, and a proportionable number of common bees. The result was, that, in the first glass, there was no impregnation, the eggs remained in the same state they were in when put into the glass; and, on giving the bees their liberty on the seventh day, they all flew away, as was found to be the case in the former experiment: whereas, in the second glass, the very day after the bees had been put into it, the eggs were impregnated by the drones, the bees did not leave their hives on receiving their liberty, the eggs, at the usual time, underwent the necessary transformations, and produced a numerous young colony.

It has been said by naturalists, that the queen-bees are produced in a manner peculiar to themselves, and different from the drones and working-bees. Some have supposed, that the eggs laid by the queen in a hive, and destined for the production of queen-bees, are of a peculiar kind: but though this is not the case, as M. Schirach has lately discovered, yet there are particular cells appropriated for this purpose, as we have seen above. These cells are generally near the edges, and at the bottom of the combs, and sometimes on the sides of a honey-comb; they are of an oblong orbicular form, and very strong; and are more or less numerous in different hives as occasion seems to require. It has been also supposed, that the matter with which they are nourished, is of a different kind and quality from that employed for the nourishment of the other bees; that which has been collected out of the royal cells, being of a gummy glutinous nature, of a deep transparent red, and dissolving in the fire, rather than crumbling to powder.

It is a prevailing notion, that the queen-bee is the only female contained in the hive; and that the working-bees are of neither sex. But M. Schirach has established a different doctrine, which has been also confirmed by the later observations of Mr. Debraw (Philos. Trans. vol. 67. part i.). According to M. Schirach, all the working or common bees are females in disguise; and the queen-bee lays only two kinds of eggs, viz. those which are to produce the drones, and those from which the working-bees are to proceed; and from any one or more of these, one or more queens may be produced; so that every worm, of the latter or common kind, which has been hatched about three days, is capable, under certain circumstances, of becoming the queen or mother of a hive. In proof of this doctrine, new and singular as it may seem, he alleges a number of satisfactory and decisive experiments, which have been since verified by those of Mr. Debraw. In the early months of the spring, and in any preceding month, even so late as November, he cut off from an old hive a piece of that part of the comb which contains the eggs of the working-bees; taking care, however, that it contained likewise worms which had been hatched about three days. He fixed this in an empty hive, or box, together with a portion of honey-comb, &c. or, in other words, with a sufficiency of food and building materials, or wax, for the use of the intended colony. He then put into, and confined within the same box, a sufficient number of common working-bees, taken from the same or any other hive. As soon as the members of this small community found themselves deprived of their liberty, and without a queen, a dreadful uproar ensued, which continued generally, with some short intervals of silence, for the space of about twenty-four hours; during which time, it is supposed, they were alternately meditating and holding council on the future support of the new republic. On the final cessation of this tumult, the general and almost constant result was, that they betook themselves to work; first proceeding to the construction of a royal cell, and then taking the proper measures for hatching and feeding the brood inclosed with them. Sometimes, even on the second day, the foundations of one or more royal cells were to be perceived; the view of which furnished certain indications, that they had elected one of the inclosed animals to the sovereignty.

But to return, the operation has been hitherto conducted in the house, but these new colonies may now be safely trusted in the garden, if the weather be warm; and may have the liberty allowed them of passing out of the box, of which they instantly avail themselves, and are seen, in a short time, almost totally to desert their new habitations. In about two hours, however, they begin to re-enter them. We should not neglect to observe, however, that if they be placed near the old hive, from which they were taken, they will very often attempt to enter it, but are as constantly repulsed by their former companions and brethren. It is prudent, therefore, to place them at a distance from the mother state, in order to avoid the inconveniences of a civil war. The final result of the experiment is, that a colony of working-bees thus shut up, with a morsel of common brood, not only hatch it, but are found, at the end of eighteen or twenty days, to have produced from thence one or two queens: which have apparently proceeded from worms of the common sort, pitched upon by them for that purpose; and which, under other circumstances, that is, if they had remained in the old hive, there is reason to suppose would have been changed into common working-bees. In the present instance, the common worm appears to be converted by them into a queen-bee, merely because the hive was in want of one. Hence we may justly infer, that the kingdom of the bees is not, if the expression may be used, a *jure divino*, or hereditary monarchy, but an elective kingdom; in

which the choice of their future ruler is made by the body of the people, while she is yet in the cradle, or in embryo; and who are determined by motives of preference, which will, perhaps, for ever elude the penetration of the most sagacious inquirers. This is however contrary to the above opinion.

And the results from experiments of the preceding kind, often repeated by M. Schirach, and others, with the same success, are, that all the common or working-bees were originally of the female sex; but that, when they have undergone their last metamorphosis, they are condemned to a state of perpetual virginity, and the organs of generation are obliterated; merely because they have not been lodged, fed, and brought up in a particular manner, while they were in the worm-state. He supposes, that the worm, designed by the community to be a queen, or mother, owes its metamorphosis into a queen, partly to the extraordinary size of its cell, and its peculiar position in it; but principally to a certain appropriate nourishment found there, and carefully administered to it by the working-bees while it was in the worm-state; by which, and possibly other means unknown, the developement and extension of the germ of the female organs, previously existing in the embryo, is effected; and those differences in its form and size are produced, which afterwards so remarkably distinguish it from the common working-bees. This discovery is capable of being applied towards forming artificial swarms or new colonies of bees, by which means their number might be multiplied, and their produce in honey and wax proportionably increased.

Swarms.—For three or four nights before a swarm sallies forth, there is in the hive a peculiar humming noise, of which authors give very different descriptions. Every sound among bees arises from their striking their wings against the air: their wings being their sole organ of sound, if we may be allowed the expression. By moving their wings more or less forcibly, they beat the air, and form the varied and confused sound which we call humming. The noise which foretells their swarming, is easily distinguished by those who are accustomed to it, and is more especially observed before the casts, or second and following swarms. The hive appears so full of bees, that part of them hang in clusters on the outside; and the drones are perceived flying about in greater numbers than usual. But the most certain sign, and which really indicates this event to be near, is, that the bees refrain from flying into the fields, though the season seems inviting. Just before they take their flight, there is an uncommon silence in the hive, and this continues for some time: but as soon as one breaks forth, they all follow, and are instantly on the wing. They seldom swarm before the sun has warmed the air; that is, not before ten in the morning, and seldom later than three in the afternoon: and the time of the year in which they most generally swarm, is from the middle of May, to the end of June; but sooner or later, according as the season is more or less favourable. The earliest swarms do not always prove the best, especially if they are not so early as the end of April or beginning of May: for the weather often is afterwards so wet and cold, that they are in danger of being destroyed, or greatly reduced by famine. Though swarms which issue forth so late as July are not in danger of a present famine, yet they scarcely have time and opportunity to lay in a sufficient store for the winter. Towards the season of swarming, the door of the hive should be enlarged, to give the bees the greater freedom to issue out; and it should likewise remain so for young swarms during the first fortnight or three weeks, to allow the free entrance to the bees, at that time extremely busy in collecting their necessary stores. The entrance should afterwards be gradually lessened, to prevent the otherwise easy access of enemies, of which there is great danger, especially as the autumn advances. Hives continue sometimes to send forth swarms till the old ones become too much weakened, or nearly empty. It is probable that the prolific young queens prompt the bees to swarm thus frequently; for it is certain that if there is not a young mother, qualified to bring forth a numerous progeny, though there be ever so great a number of bees, they will all remain and die rather than quit the hive.

Whenever the bees of a swarm fly high, they may frequently be made to descend lower, and settle, by throwing among them handfuls of sand or dust: it is usual at the same time to beat on a kettle or some other hollow instrument, perhaps from its being observed that the noise of thunder prompts such bees as are in the field to return home. Precautions of this kind are the more necessary, if, as Dr. Wardner, in his True Amazons, observes, "the bees always provide a place for their habitation before they swarm; either in some hollow tree, or in the hollow part of some old building, or in some deserted hive, which the swarms have already prepared, by cleaning out whatever may be offensive to their nature." Of the truth of this he gives an instance; and concludes, that "though they provide themselves with a house before they swarm, and take much pains about it, yet, if you are early enough in your taking the swarm, and they find themselves unawares in a convenient house, they have no mind generally to leave it: but if they rise again the same or next day, be sure not to hive them in the same hive again, for it is plain they have some dislike to it."

On the subject of swarms, Mr. Keys remarks, that, during the winter, stocks that are populous in the summer become reduced by age and accidents to the small quantity sometimes of a quart, and the weaker stocks sustain a proportionate diminution. The repeopling of the hives, therefore, depends on the amazing fecundity of the queen, which furnishes those new-born multitudes that constitute the swarms: and in consequence of a continued great increase, the bees feel a natural impulse to swarm. This law they are impatient to obey, in defiance of all the obstacles that the ingenuity of man has contrived to its taking place. A swarm does not consist of all young bees, but of old and young promiscuously blended together. The breeding of young bees is begun sooner or later, in proportion to the fruitfulness of the queen, the populousness of the stock, the goodness of the situation, and of the weather. The more numerous the bees are in the hive, the greater will be the heat to enable the queen to begin breeding earlier than those of other stocks. When bees are carefully supplied with food,

in spring, they breed fast, even in bad weather. When January proves mild, the breeding will sometimes commence at the latter end of that month; but often in February, and in March generally. As soon as bees carry in farina, or yellow balls, on their legs, it is a sure sign of the queen's having begun to breed. A long season of cold and wet weather retards the hatching or increasing of the breed, causing many abortions, and not uncommonly that of the royal nymphs. They may be seen cast out in such unkindly seasons.

If the spring be not very cold, but wet, he says, it will not favour the production of royal brood; yet the common cells will be filled with young, but no addition of honey; which will cause the bees to be very anxious to swarm, and very irritable, flying about the hive in confusion and discontent. He has several times seen royal cells, in which the workers were continually introducing their heads, he supposes, to feed the maggot; but, after a few days, they entirely neglected them, probably as being abortive. In such cases, no swarm can rise, until another birth yields a princess. In spring, when bees that are in no want of food suddenly give over carrying, it may denote the unprolificness of the queen; and if the hive contain but few bees, they had better be united to another stock. And in forward springs, when the workers are few, but the queen very pregnant, she will be obliged to deposit her eggs faster than the small number of bees can supply the maggots with sustenance: they will therefore perish, and be cast out.—This is a disadvantage which arises from keeping weak stocks.

In order to judge of the fulness of a hive in May, observe the numbers of bees that enter the respective hives, and form an estimate. Queens are not equally fruitful. While some breed slowly, or not at all, others will speedily increase in prodigious numbers. Sterile queens should be exchanged for the spare queen of a swarm; or at taking-up time destroyed, and a new stock substituted. From the middle of May to the middle of June is the most advantageous time for swarming.

The increase of swarms in calm situations, is frequently three from a hive; and swarms will emit swarms, or maiden ones. But it is to be observed, that in these cases the production of honey is proportionably less, not even near so much as might be expected from the multitude of bees, for the reasons before assigned.

And in all situations that have plenty of farina, the bees are remarkably forward and active. In the heath countries, on the contrary, they are later in their productions than in other situations, seldom swarming till the end of July. In general, the bleaker the situation, the later the swarms. A wet early season prevents the gathering of farina: then late swarms will be the consequence; and if the weather should continue very indifferent, they will rise when least expected, and frequently be lost. After the first, or prime swarms have risen, the succeeding ones should be returned to the stock; for if a second is emitted, it so much impoverishes the stock, that little honey can be collected afterwards, and will not leave a sufficiency of bees to rear the young, which at that time are abundant.

A large early swarm, with good weather succeeding, will be far more productive than a similar one that rises later; for having more time before them, their hives will be furnished with combs and brood before the honey-harvest commences, and then they are prepared with empty cells and young workers, that will, in a short time, enable them to collect a large store of honey, if care has been previously taken to provide them with spacious room. If bad weather should intervene, it will be prudent to feed them, for which their subsequent labour will amply recompense. With respect to those stocks which do not seem to increase in numbers, or appear to have drones, a dozen or two should be taken from another stock that has plenty, and put to them. To effect this, in a fine sunny afternoon, when the drones issue out most, take them singly with the finger and thumb as they pass on the resting-board, and put them into a long phial, held ready in the other hand, till the number wanted is obtained: stop the phial with a notched cork, and at night fasten the mouth of the phial to the door-way of the hive, and by morning they will have entered. Those who kill the drones in the spring, are not aware that thereby they are destroying the only means of increase. But if it should be observed that the drones in summer are so abundant, especially of a weak stock, as nearly to consume the honey as fast as gathered,—in this case, and this only, some of them may be destroyed.

The lying, or clustering out of bees, on or about a hive, has been commonly looked upon as a sign of their being ready to swarm: but this is deceitful. It indeed may denote that there are bees enough to compose a swarm; but it is also a token that there is no princess to go with them; for, in case of want of room, they often continue clustered several weeks.

As the profit on bees depends, in a great measure, on the detention of the swarms—if they are lost, the increase of honey can be but trifling, however carefully all other particulars are observed. A casual inspection will not, therefore, answer this important purpose: they must be constantly watched.

As none but good swarms at any time ought to be kept, it will be necessary to ascertain how such may be known. They should be in bulk, when hived, not less than a peck and a half each, in any case.

Artificial Swarms.—In regard to artificial swarming, Mr. Keys concludes, that as nature has implanted in bees a strong propensity to swarm, as a quality necessarily connected with the manner and season, all our attempts by force or allurements to effect or prevent it, with a tolerable degree of timely advantage, must prove ineffectual. He proposes the two following methods however; as, if not successful, they will not, he says, be prejudicial to the stocks, may amuse the curious, and be accomplished without much trouble; but they are inapplicable to general practice: First, by often looking through the windows of storied boxes, in the swarming season, sometimes a queen may be seen in one of the boxes. Immediately shove a divider between the two boxes. Leave them about

an hour; when, if the bees of both boxes remain quiet, wait some time longer, and then repeat the inspection, by intervals, two or three times, till the approach of night; and if they are still in a quiet state, introduce the other divider, and take the duplet to a distant station. On the contrary, if the bees of either box have showed signs of discontent, it is a token there is no queen in that which shows uneasiness; and therefore the divider must be withdrawn till another favourable opportunity offers. The second method is this: in the swarming season, when the bees seem very numerous, and show indications of swarming, shove a divider between a duplet in the morning, having before opened both doors; and if the bees remain quiet, and pursue their work in both boxes till the evening, proceed with them as above. But if the bees of either box are confused, take out the divider, and try your fortune another time.

An artificial swarm may be made, by purchasing one or more of second or third swarms of your neighbours, as they will be of little value to them, and therefore may be had cheap. Unite as many of them in one hive as are sufficient to form a good swarm, by placing the fewest in number to the most populous; fuming them first, to prevent quarrelling. But if such should happen, fumigate the duplet.

Hiving Swarms.—The same author says, that as swarms frequently rise when not expected, and that with precipitation, as seen in *pl.* IX. *fig.* 8. common prudence, it might be thought, would induce apiators to have constantly hives in readiness. But he has often seen the contrary to be the case, though the expense of the hives would be less when bought early, and would also avoid the risk of losing a swarm while seeking for them.

As soon as the swarm is settled, however, the bees which compose it should be got into a hive with all convenient speed, to prevent their taking wing again. If they settle on a small branch of a tree, easy to be come at, it may be cut off, and laid upon a cloth,—the hive being ready immediately to put over them. If the branch cannot be conveniently cut, the bees may be swept from off it into a hive. Lodge but the *queen* in the hive, and the rest will soon follow. Where the bees must be considerably disturbed, in order to get them into the hive, the most advisable way is, to let them remain in the place where they have pitched, till the evening, when there is less danger of their taking wing. If it be observed that they still hover about the place they first alighted upon, the branches there may be rubbed with rue, or elder-leaves, or any thing disagreeable to them, to prevent their returning to it. The hive employed on this occasion, should be cleaned with the utmost care, and its inside be rubbed very hard with a coarse cloth, to get off the loose straws, or other impurities, which might cost them a great deal of time and labour to remove. It may then be rubbed with fragrant herbs or flowers, the smell of which is agreeable to the bees, or with honey. It should not be immediately set on the stand where it is to remain, but kept near the place where the bees settle till the evening, lest some stragglers be left; and it should be shaded either with boughs, or with a cloth, that the too great heat of the sun may not annoy the bees.

We sometimes see a swarm of bees, after having left their hive, and even alighted upon a tree, return to their first abode. This never happens, however, but when the young queen did not come forth with them for want of strength, or perhaps courage to trust to her wings for the first time; or possibly from a consciousness of her not being impregnated. Bees are not apt to sting when they swarm, except the weather be stormy; therefore it is not necessary to take much extraordinary precaution against them. It is however advisable, for those who are not accustomed to them, to cover their face and hands.

Neither the second swarm, nor much less the subsequent ones, are worth keeping single; because, being few in number, they cannot allow so large a proportion of working-bees to go abroad in search of store, as more numerous swarms can, after having appointed a proper number for the various works to be done within. For this reason, it is advisable to unite two or more of these last or latter swarms into one hive, so as to procure a sufficient number of bees in one hive. Bees sometimes swarm so often, that the mother-hive is too much weakened. In this case, the swarms should be restored; and this should also be done when a swarm produces the first summer, as it sometimes does. The best way, indeed, is to prevent such swarming, by giving the bees more room; though this will not answer when there is a young pregnant queen, she well knowing that her life is the forfeit of her remaining at home.

The common method of uniting swarms is very easy: Spread a cloth at night upon the ground close to the hive, in which the two casts or swarms are to be united; lay a stick across this cloth; then fetch the hive with the new swarm, set it over the stick, give a smart stroke on the top of the hive, and all the bees will drop down upon the cloth in a cluster. This done, throw aside the empty hive, take the other from off the stool, and set this last over the bees, who will soon ascend into it, mix with those already there, and they will become one family. Others, instead of striking the bees down upon the cloth, place, with its bottom upmost, the hive in which the united swarms are to live, and strike the bees of the other hive down into it. The former of these hives is then restored to its natural situation, and the bees of both hives soon unite. If some bees still adhere to the other hive, they may be brushed off on the cloth, and they will soon join their companions. The following method may also be taken, as giving less disturbance to the bees. Set, with its mouth upmost, the hive into which the young swarm has been put, and set upon it the other hive. The bees in the lower hive, finding themselves in an inverted situation, will soon ascend into the upper. Though all writers acknowledge that one of the queens is constantly slain on these occasions, and generally a considerable number of the working-bees, yet none of them, Columella excepted, has proposed the easy remedy of killing the queen of the latter cast or swarm, before the union is made; a means by which the lives of the working-bees may be pre-

served. This may be done either by stupifying them, and then picking her out, or by searching her out when the bees are beating down upon the cloth; for this being done in the night, to prevent the battle which might otherwise ensue, there will be no great difficulty in finding her.

When a swarm settles in several clusters, Mr. Keys advises us to hive only the largest cluster, and to remove it, a small distance at a time, nearer to the smaller clusters, which are successively to be shook off the places of clustering by a long hooked stick, repeatedly, till the buzzing of those in the hive has attracted their notice, and induced them to join. If the clusters are equal in bulk, hive both separately, and set them at a small distance from each other; and if either of them have a queen, and are dissatisfied with her, they will quit the hive, and unite with the other; but if both remain contented, unite them by fuming. And when a swarm is clustering, and another is rising, and endeavours to join it, cover the first with a thin cloth, and throw dust or water among the others, to cause them to settle elsewhere. As, likewise, if a swarm that is risen, attempts to settle on a stock-hive, stop the door, and cover the hive with a cloth. Sprinkle an empty hive with sugared ale, and place it a little raised over the top of the stock, and the swarm will enter therein. If the swarm seems too large to be contained in the hive, set another upon the first. As soon as the bees have entered, take it away, and unstop the stock. Or it may be done by stopping the door of the stock, and immediately removing it to some distance. In the interim, an assistant is to place an empty hive in its place, to which the swarm will enter; and then it is to be taken to an appropriate stand, and the stock brought back to its former situation.

In hiving, take care that none of the bees are crushed, as that provokes the others to revenge; and not only so, but it may chance to be the queen, to the ruin of the swarm. Forbear the use of weeds, or throwing water on them, when clustering or brushing them off, which they will highly resent; and it may make them fly quite away. Gently cut away all spray-twigs or branches that may obstruct the placing the hive under the cluster. Always spread a cloth on the ground, with two small wedges on it, as near the cluster as may be: the wedges are to keep the edges of the front of the hive a little raised, for the more ready entrance of the bees underneath, as also to prevent injuring any of them. The instruments necessary for hiving, are, an empty box or hive, a hive-floor, or loose board, a large cloth, two small wedges, and a long fork or crook-stick.

To hive bees, let the apiator take the hive inverted, and leisurely introduce the hive under the cluster as conveniently as can be, without disturbing the bees; then, with the left hand, give the bough two or three smart shakes, which will cause the greater part of the cluster to fall into the hive: nimbly take it away, and turn it on one edge on the floor, and the other on the wedges; draw the cloth up over the hive, leaving the raised part open. The bees, as may be expected, will be in great confusion, and make a great buzz, but will immediately begin to ascend. The bough, or bush, &c. must continually be shook by the long stick, while any bees endeavour to relodge on it: those on the wing, hearing the buzz of their companions in the hive, will gradually fly down and join them. Let them remain on the spot till the evening, except the sun should be too violent; and then the heat would make them quit the hive, unless sheltered by boughs, or the like. But if it should be inconvenient for the hive to remain, they may be removed a little way off. As soon as the bees are nearly retired into the hive, it may be carried to its destined stand; the few bees that remain on the wing, will return home.

Feeding and protecting Bees in Winter.—Providence has ordained, that insects which feed on leaves, flowers, and green succulent plants, should be in an insensible or torpid state during the time that the winter's cold has deprived them of the means of subsistence. But though bees, during all winter, are in a sort of inactive state, and little food supports them, yet as the weather is changeable, and every warm or sunny day revives them, and prompts them to return to exercise, food sometimes becomes indispensably necessary. Mr. White observes, that a greater degree of cold than is commonly imagined to be proper for bees, is favourable to them in winter. If a sharp frost, says he, continue for two or three months, without intermission, you may observe through your glass that the bees are all this time closely linked together in clusters between the combs. If they are not altogether without motion, it is certain they stir not from their places while the cold continues, and therefore eat not at all. A colony of bees, therefore, placed on the north side of a building, will waste much less of their provisions than others which stand in the sun; for, coming seldom forth, they eat little, and yet, in the spring, are as forward to work and swarm, as those which had twice as much honey in the preceding autumn. The owner should, however, examine their state in the winter: if he finds that, instead of being clustered between the combs, they fall down in numbers on the stool or bottom of the hive, the hive should be immediately carried to a warmer place, where they will soon recover.

Mild winters are very injurious to bees in this country; a small degree of warmth enlivens them, and then they eat and consume great part, and some winters all their stock of honey, which is necessary to them in a cold wet spring. The sunshine, in winter, entices them to go abroad, where, by a sudden shower of rain, or alteration in the degree of cold, they are disabled, and, if obliged to rest, are soon killed. By these accidents, many swarms, that were strong, and had large provisions of honey in autumn, are so weakened, and their stock of provision so much lessened, that they never recover so as to gather any valuable quantity of honey. But when the weather is cold, and continues so through great part of the winter, they are not so liable to these accidents as in milder winters; for, during the continuance of frosty weather, they remain inactive, torpid, and almost motionless, and eat very little or no honey. This appears to

be the reason that bees thrive so much in some countries more than in others, that in other respects seem to be equally proper for them, and is probably one principal reason of their thriving remarkably well in Poland, where the weather is not so changeable as in this island, and the cold of their winters continues longer and more uniform.

Hence another method has been thought of to preserve bees here, and prevent the waste of honey in winter, which is, by removing the hives, at the usual time of the approach of winter, into a dark vault or cellar, where, being kept cold and dark, they soon fall into a torpid state, and continue so till the flowers they feed upon, begin to be disclosed.

But, notwithstanding these means, bees frequently require to be fed and protected during the winter-months in some seasons, from the causes that have been just stated. And of all the various methods and materials for feeding them with in winter, Mr. Keys says he has found none more successful, cheap, or convenient, than soft brown sugar that is not grainy,—a pound to half a pint of mild ale, dissolved over the fire. When sugar is dear, honey may supply its place, though inferior for the purpose. This composition, which should be regulated to the consistence of syrup, comforts and strengthens the bees, preventing disorders, increasing their activity, and forwarding the brood, if given plentifully in the spring. It is to be administered by means of troughs, made of joints of elder, angelica, or other plants of the same kind, slit down the middle, the pith and bark taken away, and reduced to such a depth as easily to pass the door-ways of the hives. Their length to be eight inches, or six at the least, and flatted a little on the under side, and the end closed with putty, or other cement. These troughs, by passing far into the hive, enable the bees to come down to feed without danger from the cold, which they would suffer in coming to feed at the door. They are also too narrow to smother themselves therein. The larger the number of bees, so much the larger must be their supplies. When stocks show signs of poverty, push into the hive a trough of the honeyed ale in the evening; and if the combs obstruct its entrance, pass a long thin knife to cut a free passage. The next evening, take another trough-full, and, pulling the empty one out, push in the full one; and thus proceed as long as there is occasion. If stocks do not come down to feed, they should be taken into the house and fed. Such a trough holds about half an ounce; one of them is enough for any stock for a day and night. By this method they are prevented from feeding to excess, which they are but too apt to do when they have an abundant supply at once, and thereby bring on a looseness, and prove both destructive and wasteful. Daily feeding, indeed, is more troublesome than giving a quantity at once; but the last is more expensive, and not so safe. During this, care should be taken to place no feeding article on the outside, or at the door-ways, as it will attract strange bees, who may also become robbers, and ruin the stocks.

In a disastrous season, a more public mode of feeding may be necessary, which is, by taking an old empty comb, the deeper and harder the better, and filling the cells on one side with honeyed ale, and placing it on a hive-floor, and over that an empty hive or pan, and setting it about the middle of the apiary. The bees will soon flock about it in crowds, and empty the comb: once in twenty-four hours it should be replenished. The bees will not come out to feed in improper weather, though it continue for three or four days. Troughs of food must therefore be substituted during bad weather. Feeding should not be attempted until the robbing season is over. If any stocks before that time are in distress, they should have a trough given them at night, and withdrawn in the morning.

The weighing or poising of hives in February, to judge whether they require feeding, ought not to be deferred till after they have, for some time, begun to breed, lest the additional weight of them be mistaken for that of honey, when, perhaps, there may not be a spoonful in the hive, and the continual increase of mouths produce the speedier famine. Now and then a trough of food given to the stocks, as soon as farina is collected, will forward the queen's breeding, and likewise add much to invigorate the bees to greater activity in their labour.

On the whole, he has been induced to conclude, that a trough, holding about half an ounce of honeyed-ale, daily administered, is a sufficient support to any stock while feeding is required.

The feeding of bees in spring is of great advantage to them, as it enlivens and strengthens them, and stimulates their activity, causing them to breed the earlier. And a little good ale, with honey dissolved in it, will be very acceptable, even though they should be well provided.

There is another good mode of feeding, which is, by taking a half-hive or box, cutting combs of honey down to the proper depth, and placing them therein, on bars similar to those of the stock which they are to be set over. Loosen the cover, thrust a divider under it, take it off, and then carefully set the half-box of combs upon the divider, and immediately withdraw it, and place a cover over the stock. The quantity of combs put in, must be proportionate to the wants of the bees, to the time of its application, and the nature of the season.

Taking the Honey and Wax.—The general method in this country is to destroy the bees at the time they are robbed of the produce of their labours. When those swarms, which are doomed for destruction, have been marked out, which is generally done in September, a hole is dug near the hive, and a stick, at the end of which is a rag that has been dipped in melted brimstone, being stuck in the hole, the rag is set on fire, the hive being immediately set over it, and the earth instantly thrown up all around, so that none of the smoke can escape. In a quarter of an hour all the bees are seemingly dead, and they will soon after be irrecoverably so, by being buried in the earth that is returned back into the hole, and by this last means it is, that they are completely destroyed; as it has been found, by experiment, that all the bees which have been affected only by the fume of the brimstone

recover again, excepting such as have been singed or hurt by the flame. Hence it is evident, that the fume of brimstone might be used for stupifying the bees, with some few precautions. The heaviest and the lightest hives are alike treated in this manner; the former, because they yield the most profit with an immediate return; and the latter, because they would not be able to survive the winter. Those hives, which weigh from fifteen to twenty pounds, are thought to be the fittest for keeping.

The practice of the ancients was, however, very different from this: they were content to share with these industrious insects the produce of their labours; and some very laudable attempts have lately been made in this country to attain the desirable end of getting the honey and wax without destroying the bees. John Geddy, Esq. published, in the year 1665, his invention of boxes for preserving the lives of bees. These were improved by Joseph Warder, physician, at Croydon, who, at the same time, embellished his account of the structure and use of these boxes, with several other curious circumstances concerning bees. Mr. Thorley and Mr. White have also brought the method of preserving the lives of bees to still greater perfection. The former, in his *Enquiry into the Nature, Order, and Government of Bees*, thinks colonies preferable to hives for the following reasons:—First, the more certain preservation of many thousands of these noble and useful creatures: Secondly, their greater strength, which consists in numbers, and consequently their greater safety from robbers: Thirdly, their greater wealth, arising from the united labours of the greater number. He tells us, that he has in some summers taken two boxes filled with honey from one colony, and yet sufficient store has been left for their maintenance during the winter, each box weighing forty pounds. Add to these advantages, the pleasure of viewing them with the greatest safety, at all seasons, even in the busiest time of gathering, and their requiring a much less attendance in swarming-time. The bees thus managed, are also more effectually secured from wet and cold, from mice, and other vermin. The boxes which he uses are made of deal, which, being spongy, sucks up the moisture of the bees sooner than a more solid wood. Yellow deal, thoroughly seasoned, is the best. An octagon, as being nearer to a sphere, he thinks better than a square form; for, as the bees in winter lie in a round body near the centre of the hive, a due heat is then conveyed to all the out-parts, and the honey is kept from candying. The dimensions which, after many years experience, he recommends for the boxes, are ten inches deep and twelve or fourteen inches broad in the inside. He has tried boxes containing a bushel or more, but found them not to answer the design like those of a smaller size.

The top of the box should be made of an entire board, a full inch thick after it has been planed, and it should project on all sides at least an inch beyond the dimensions of the box. In the middle of this top there must be a hole five inches square for a communication between the boxes; and this hole should be covered with a sliding shutter of deal or elm, running easily in a groove over the back-window. The eight pannels, nine inches deep, and three quarters of an inch thick, when planed, are to be let into the top, so far as to keep them in their proper places; to be secured at the corners with plates of brass, and to be cramped with wires at the bottom, to keep them firm, for the heat in summer will try their strength. There should be a glass window behind, fixed in a frame, with a thin deal cover, two small brass hinges, and a button to fasten it. This window will be sufficient for inspecting the progress of the bees. Two brass handles, one on each side, are necessary to lift up the box: these should be fixed in with two thin plates of iron, near three inches long, so as to turn up and down, and put three inches below the top board, which is nailed close down with sprigs to the other parts of the box. Those who chuse a frame within, to which the bees may fasten their combs, need only use a couple of deal sticks, of an inch square, placed across the box, and supported by two pins of brass, one an inch and a half below the top, and the other two inches below it; by which means the combs will quickly find a rest. One thing more, which perfects the work, is a passage four or five inches long, and less than half an inch deep, for the bees to go in and out at the bottom of the box.

In keeping bees in colonies, houses or sheds will be requisite for the protection of the boxes as well as the bees. They may be made of any kind of wood, but deal is probably the best; and they should be constructed of sizes proportioned to the number of colonies to be kept, and with strong floors made in the manner hereafter described.

In planting colonies of bees, Mr. Foster observes, the best time is either in spring with new stocks full of bees, or in summer with swarms. If swarms are used, procure, if possible, two of the same day; hive them either in two boxes, or in a hive and a box; at night, place them in the bee-house, one over the other, and, with a knife and a little lime and hair, stop close the mouth of the hive, or upper-box, so that not a bee may be able to go in or out, but at the front door. This done, you will in a week or ten days with pleasure see the combs appear in the boxes; but if it be an hive, nothing can be seen till the bees have wrought down into the box. Never plant a colony with a single swarm, as has sometimes been done, but with little success.

When the second box, or the box under the hive, appears full of bees and combs, it is time to raise your colony. This should be done in the dusk of the evening, and in the following manner. Place your empty box, with the sliding-shutter drawn back, behind the house, near the colony that is to be raised, and at nearly the height of the floor; then lifting up the colony with what expedition you can, let the empty box be put in the place where it is to stand, and the colony upon it, and shut up the mouth of the then upper-box, with lime and hair, as before directed. When, by the help of the windows in the back of the boxes, you find the middle box full of combs, and a

quantity of honey sealed up in it, the lowest box half full of combs, and few bees in the uppermost box, proceed thus: About five o'clock in the afternoon, drive close with a mallet, the sliding-shutter under the hive or box that is to be taken from the colony. If the combs are new, the shutter may be forced home without a mallet; but be sure it be close, that no bees may ascend into the hive or box to be removed. After this, shut close the doors of your house, and leave the bees thus cut off from the rest of their companions for the space of half an hour or more. In this time, having lost their queen, they will fill themselves with honey, and be impatient to be set at liberty.

If, in this interval, you examine the box or boxes beneath, and observe all to be quiet in them, you may be confident that the queen is there, and in safety. Hereupon raise the back part of the hive or box so far, by a piece of wood slipped under it, as to give the prisoners room to come out, and they will return to their fellows: then lifting the box from off the colony, and turning it bottom upmost, cover it with a cloth all night; and the next morning, when this cloth is removed, the bees that may have remained in it will return to the colony. Thus you have a hive or box of honey, and all your bees safe.

Mr. Thorley informs us, that the method he has pursued with great success for many years, and which he recommends to the public as the most effectual for preserving bees in common hives, is incorporation, or uniting two stocks into one, by the help of a peculiar fume or opiate, which will put them entirely in your power for a time, to divide and dispose of at pleasure. But as that dominion over them will be of short duration, you must be expeditious in this business. The queen is immediately to be searched for and killed. Hives which have swarmed twice, and are consequently reduced in their numbers, are the fittest to be joined together, as this will greatly strengthen and improve them. If a hive which you would take, is both rich in honey, and full of bees, it is but dividing the bees into two parts, and putting them into two boxes instead of one. Examine whether the stock to which you intend to join the bees of another, have honey enough in it to maintain the bees of both: it should weigh full twenty pounds.

This narcotic, or stupifying fume, is made from the *fungus maximus*, or *pulverulentus*, the large mushroom, commonly known by the name *bunt*, *puckfist*, or *frog-cheese*. It is very large, and, when ripe, is of a brown colour, turns to powder, and is exceedingly light. Put one of these *pucks* into a large paper, press it therein to two-thirds, or near half the bulk of its former size, and tie it up very close; then put it into an oven some time after the bread has been drawn, and let it remain there all night: when it is dry enough to hold fire, it is fit for use. The manner of using it is this: Cut off a piece of the *puck*, as large as a hen's egg, and fix it in the end of a small stick slit for that purpose, and sharpened at the other end, which place so that the puck may hang near the middle of an empty hive. This hive must be set with the mouth upward, in a pail or bucket, which shall hold it steady near the stock you intend to take. This being done, set fire to the puck, and immediately place the stock of bees over it, tying a cloth round the hives, that no smoke may come forth. In a minute's time, or little more, you will hear the bees fall like drops of hail, into the empty hive. You may then beat the top of the full hive gently with your hand, to get as many of them as you can: after this, loosing the cloth, lift the hive off to a table, knock it several times against the table, several more bees will tumble out, and perhaps the queen among them. She often is one of the last that falls. If she is not there, search for her among the main body in the empty hive, spreading them for this purpose on a table. You must proceed in the same manner with the other hive, with the bees of which these are to be united. One of the queens being secured, you must put the bees of both hives together, mingle them thoroughly, and drop them among the combs of the hive which they are intended to inhabit. When they are all in, cover it with coarse cloth, which will admit air, and let them remain shut up all that night, and the next day. You will soon be sensible that they are awaked from this sleep. The second night after their union, in the dusk of the evening, gently remove the cloth from off the mouth of the hive, and the bees will immediately sally forth with a great noise; but, being too late, they will soon return; then, inserting two pieces of tobacco-pipes to let in air, keep them confined for three or four days, after which the door may be left open.

The above apparatus of boxes has since been much improved by his son and successor, as is shown at *fig.* 14. *pl.* IX. where the bottom part, marked *a*, is an octangular bee-box, made of deal boards, about an inch in thickness, the cover of which is about seventeen inches in diameter, but the internal part only $15\frac{1}{2}$, and its height ten inches. In the middle of the cover of this octangular box, is a hole, which may be opened or shut at pleasure, by means of a slider *d*. In one of the pannels is a pane of glass, covered with a wooden door, *e*. The entrance, *f*, at the bottom of the box, is about three inches and a half broad, and half an inch high. Two slips of deal, about half an inch square, cross each other in the centre of the box, and are fastened to the pannels by means of small screws. To these slips the bees fasten their combs.

In this octangular box the bees are hived, after swarming in the usual manner, and there suffered to continue till they have built their combs, and filled them with honey, which may be known from opening the door, and viewing their works through the glass pane, or by the weight of the hive. When the bee-master finds his bees have filled their habitation, he is to place a common bee-hive of straw, represented at *b*, made either flat at the top, or in the common form, on the octangular box, and draw out the slider, by which a communication will be opened between the box and the bee-hive; the consequence of which will be, that those insects will fill this hive also. When the straw-hive is well filled, he may push in the slider, and take it away, placing another immediately in its room, and then drawing out the slider. These indefatigable creatures fill the new hive in the same manner. By proceeding in this method, Mr. Thorley says, that he

has taken three successive hives, filled with honey and wax, from one single hive, during the same summer; and that after he had laid his insects under so large a contribution, the food still remaining in the octangular box was abundantly sufficient for their support during the winter. He adds, that if this method were pursued in every part of the kingdom, instead of that cruel method of putting the bees to death, he is persuaded, from long experience, that wax would be collected in such plenty that candles might be made with it, and sold as cheap as those of tallow are at present.

He has also added another part to his bee-hive, which cannot fail of affording the highest entertainment to the curious and inquisitive. It consists of a glass receiver, represented at *c*, eighteen inches in height, eight inches in diameter at the bottom, and in the greatest part thirteen. This receiver has a hole at the top, about an inch in diameter, through which a square piece of deal is extended nearly to the bottom of the vessel, having two cross-bars to which the bees fasten their combs. When the bees have filled their straw-hive, which must have a hole in the centre, covered with a piece of tin, he places the glass *c* upon the top of the straw-hive, and draws out the piece of tin: the bees, now finding their habitation enlarged, pursue their labours with such alacrity, that they fill this glass-hive likewise with their stores. And as this receptacle is wholly transparent, the curious observer may entertain himself in viewing the whole progress of their works.

It will, however, be necessary to cover the glass with an empty hive of straw, or at least with a cloth, which may be easily removed when you inspect the bees, lest too much light prevent them from working.

When the glass is completely filled, slide a tin-plate between it and the hive or box, so as to cover the passage, and in half an hour the glass may be taken off with safety. The few bees that remain in it will readily go to their companions. He has also added a glass window to his straw-hives, in order to see what progress the bees make; which is of some importance, especially if one hive is to be taken away while the season still continues favourable for their collecting of honey: for when the combs are filled with honey, the cells are sealed up, and the bees forsake them, and reside mostly in the hive in which their works are chiefly carried on. Observing also that as the bees were apt to extend their combs through the passage of communication into the upper hive, whether glass or other kinds, which rendered it necessary to divide the comb when the upper hive was taken away, he now puts in that passage a wire-screen or netting, the meshes of which are large enough for a loaded bee to go easily through them: this prevents the joining of the combs from one box to the other, and consequently obviates the necessity of cutting them, and of spilling some honey, which, running down amongst the crowd of bees, used before to incommode them much; it being difficult for them to clear their wings of it.

Mr. White's method of taking away as much honey as can be spared, without destroying or starving the bees, and to encourage seasonable swarms, is likewise deserving of notice.

His bee-box may be made of deal or any other well-seasoned boards which are not apt to warp or split. The boards should be near an inch thick: the figure of the box square, and its height and breadth nine inches, and five-eighths every way, measuring within. With these dimensions, it will contain near a peck and a half. The front part must have a door cut in the middle of the bottom edge, three inches wide, and near half an inch in height, which will give free liberty to the bees to pass through, yet not be large enough for their enemy the mouse to enter. In the back part, you must cut a hole with a rabbet in it, in which you are to fix a pane of the clearest and best crown glass, about five inches in length, and three in breadth, and fasten it with putty: let the top of the glass be placed as high as the roof withinside, that you may see the upper part of the combs, where the bees with their riches are mostly placed. You will, by this means, be better able to judge of their state and strength than if your glass was fixed in the middle. The glass must be covered with a thin piece of board, by way of shutter, which may be made to hang by a string, or turn upon a nail, or slide sideways between two mouldings. Such persons as are desirous of seeing more of the bees' works, may make the glass as large as the box will admit, without weakening it too much; or they may add a pane of glass on the top, which must likewise be covered with a shutter, fastened down with pegs to prevent accidents. The side of the box, which is to be joined to another box of the same form and dimensions, as it will not be exposed to the external air, may be made of a piece of slit deal not half an inch thick. This is called the side of communication, because it is not to be wholly inclosed: a space is to be left at the bottom the whole breadth of the box, and a little more than an inch in height, and a hole or passage is to be made at top, three inches long, and more than half an inch wide. Through these the bees are to have a communication from one box to the other. The lower communication being on the floor, the labourers, with their burthens, may readily and easily ascend into either of the boxes. The upper communication is only intended as a passage between the boxes, resembling the little holes, or narrow passes, which may be observed in the combs formed, in order to save time and shorten the way when they have occasion to pass from one comb to another.

In the next place you are to provide a loose board, half an inch thick, and large enough to cover the side where you have made the communication. You are likewise to have in readiness several little iron staples, an inch and half long, with the two points or ends bended down more than half an inch. The use of these will be seen presently. You have now only to fix two sticks crossing the box from side to side, and crossing each other, to be a stay to the combs; one about three inches from the bottom, the other the same distance from the top; and, when you have painted the whole, one box is finished.

This box is little more than five square pieces of

board nailed together; so that a poor cottager, who has but ingenuity enough to saw a board into the given dimensions, and to drive a nail, may make his own boxes well enough, without the help or expense of a carpenter. The other box must be of the same form and dimensions. The two boxes differing only in this, that the side of communication of the one must be on the right-hand, while that of the other is on the left. Two of these boxes, with their openings of communication ready to join each other, are represented at *fig.* 15. *pl.* IX.

The manner of hiving a swarm into one or more of these boxes is thus described. Take the loose board, and fasten it to one of the boxes, so as to stop the communications: This may be done by three of the staples before-mentioned; one on the top of the box near the front; the two others on the back, near the top and near the bottom. Let one end of the staple be thrust into a gimblet-hole made in the box, so that the other end may go as tight as can be over the loose board, to keep it from slipping when it is handled. The next morning, after the bees have been hived in this box, the other box should be added, and the loose board should be taken away. This will prevent a great deal of labour to the bees, and some to the proprietor. The shutter should be kept close to the glass, that no light may enter through it: for the bees seem to look upon such light as a hole or breach in their house, and on that account may not so well like their new habitation. But the principal thing to be observed at this time, is to cover the box, as soon as the bees are hived, with a linen-cloth thrown loosely over it, or with green boughs, to protect it from the heat of the sun. Boxes will admit the heat much sooner than straw-hives; and if the bees find their house too hot, they will leave it. If the swarm be larger than usual, instead of fastening the loose board to one box, you may join two boxes together with three staples, leaving the communication open from one to the other, and then hive your bees into both. In all other respects they are to be hived in boxes after the same manner as in common hives. The door of the second box should be carefully stopped up, and be kept constantly closed, in order that the bees may not have any entrance but through the first box.

When the boxes are set in the places where they are to remain, they must be screened from the summer's sun, because the wood will be otherwise heated to a greater degree than either the bees or their works can bear; and they should likewise be screened from the winter's sun, because the warmth of this will draw the bees from that lethargic state which is natural to them, as well as prevent the entrance of many other insects, in the winter season. For this purpose, and also to shelter the boxes from rain, Mr. White contrived the following frame.

Fig. 16. *pl.* IX. represents the front of a frame for twelve colonies; *a*, *a*, are two cells of oak, lying flat on the ground, more than four feet long. In these cells you are to fix four oaken posts, about the thickness of such as are used for drying linen. The two posts, *b*, *b*, in the front, are about six feet two inches above the cells; the other two standing backwards five feet eight inches. You are next to nail some boards of slit deal horizontally from one of the fore-posts to the other, to screen the bees from the sun. Let these boards be seven feet seven inches in length, and nailed to the inside of the posts, and be well seasoned, that they may not shrink or gape in the joints. *c*, *c*, are two splints of deal, to keep the boards even, and strengthen them. *Fig.* 17 represents the back of the frame. *d*, *d*, *d*, *d*, are four strong boards of the same length with the frame, on which you are to place the boxes. Let the upper side of them be very smooth and even, that the boxes may stand true upon them; or it may be still more advisable to place under every pair of boxes a smooth thin board, as long as the boxes, and about a quarter of an inch wider. The bees will soon fasten the boxes to this board in such manner, that you may move or weigh the boxes and board together, without breaking the wax or resin, which for many reasons ought to be avoided. These floors must be supported by pieces of wood, or bearers *a*, *a*, &c. which are nailed from post to post at each end. They are likewise to be well nailed to the frame, to keep them from sinking with the weight of the boxes; *f* represents the roof, which projects backward about seven or eight inches beyond the boxes, to shelter them from rain. You have now only to cut niches or holes in the frame, over against each mouth or entrance into the boxes, at *h*, *h*, *h*, in *fig.* 16. Let these niches be near four inches long; and under each you must nail a small piece of wood for the bees to alight upon. The morning or evening sun will shine upon one or both ends of the frame, let its aspect be what it may: but you may prevent its over-heating the boxes, by a loose board set up between the posts, and kept in by two or three small pegs.

The same gentleman has shown, that it is evidently more to our advantage to spare the lives of bees, and be content with part of their stores, than to kill and take possession of the whole. About the latter end of August, he observes, by a little inspection through the glasses, one may easily discover which of the colonies may be laid under contribution. Such as have filled a box and a half with their works will pretty readily yield you the half box. But you are not to depend upon the quantity of combs, without examining how they are stored with honey. The most proper time for this business is the middle of the day: and, as you stand behind the frame, you will need no armour except a pair of gloves. The operation itself is very simple, and easily performed, thus: Open the mouth of the box you intend to take; then, with a thin knife, cut through the resin with which the bees have joined the boxes to each other, till you find that you have separated them; and after this thrust a sheet of tin gently in between the boxes. The communication being thereby stopped, the bees in the fullest box, where most likely the queen is, will be a little disturbed at the operation; but those in the other box, where we suppose the queen is not, will run to and fro in the utmost hurry and confusion, and send forth a mournful cry, easily distinguished

from their other notes. They will issue out at the newly-opened door; not in a body, as when they swarm, nor with such calm and cheerful activity as when they go forth to their labours; but by one or two at a time, with a wild flutter, and visible rage and disorder. This, however, is soon over; for as soon as they get abroad, and spy their fellows, they fly to them instantly, and join them at the mouth of the other box. By this means in an hour or two, for they go out slowly, you will have a box of pure honey, without a living bee in it to molest you; and likewise without dead bees, which, when you harm them, are often mixed with the honey, and both waste and damage it.

Those boxes are not only very convenient for taking away part of the honey without breaking the combs, or without killing any of the bees, or much disturbing them, but also on two other accounts: first, for feeding weak swarms, or such whose stock of provision is exhausted, and require to be fed to keep them alive, the usual methods of feeding them with sugar and other substances being often ineffectual: and even honey is in some degree so also, for several reasons, but principally because the natural food of bees is not honey alone; and whether bee-bread, or whatever else, is their food, they have it ready prepared for them, by adding a box to their store that was taken from them, or some of the colonies, in autumn; for some of these boxes, full of combs, should be kept entire, and given them when their own store is exhausted. A colony of these boxes is also very conveniently, and with little trouble, cleared of moths, or other insects, that are pernicious or troublesome to the bees; for the boxes may be taken away from the colony singly; and after the moths, &c. are destroyed, may be immediately returned to the colony.

Storifying.—The method of storifying, or superhiving, is another method by which the honey and wax may be obtained without destroying the bees.

It is remarked by the author of the Ancient Bee-master, that of all the methods which have hitherto come to his knowledge for the conducting of bees, that of storifying yields much the greatest profit, and is the most congenial to their natural habitude and style of working. By storifying is meant the setting of one, two, or three hives over each other, as duplets or triplets. It is found that three pecks of bees in one hive will collect more honey than a bushel divided into two; because a single hive has not combs enough to receive the numerous eggs that a queen is capable of furnishing, and cells sufficient at the same time to hold the honey. Thus, being limited to a small compass, the increase must proportionally be so too. For great part of the bees are necessarily employed in rearing the young, and therefore the number of those who are occupied in collecting honey is not near so great as has been imagined. A good storifier that has not swarmed, or has had the swarm returned, will increase thirty pounds in seven days, in a favourable situation and season: whereas, a single-hived stock in the same apiary and season, that has swarmed, will not increase above five pounds in the same time. For every swarm, the least as well as the greatest, is provided with a queen, equal in fecundity to the queen of the largest stock; and as the brood she brings continually demands the labour and attendance of probably near half the bees, this circumstance renders the other moiety, from the smallness of their number, unable to accumulate a large quantity of honey in the short time it mostly abounds: whereas, by doubling and trebling the hives, the bees are never at a stand for room to extend their combs, as fast as requisite for honey or brood. Bees, considered individually, live about a year, progressively coming into birth, and as gradually decaying. It hence follows, that those born in autumn or spring, or in the intervening months, inevitably die about the same time in the succeeding periods of time, and so in a regular proportion during the breeding-season; but this is not perceived while the brood is rapidly increasing, and counterbalancing the chasms made by death. The queen, as has been noticed, often lays two or three hundred eggs in a few hours; which occasions as sudden a disappearance at the stated period, and which accounts for that great thinness observable in hives after the swarming-season is over, as if a swarm had escaped. It likewise demonstrates, that, at the general time of deprivation, all hives or stocks, according to their populousness, are composed of bees of all ages, from those in embryo, to those of old age. Consequently, although individuals die daily, young ones rise to birth to succeed them. But, by storifying, the family is perpetuated to any length of time, without the cruel necessity and trouble of destroying indiscriminately both old and young.

This method, he says, can in no case be prejudicial, though the bees should be prevented thereby from swarming: on the contrary, it would be a great advantage if it did so; for then artificial swarming would not be wanted to perpetuate stocks, which would be effected without such assistance. Writers have, however, followed each other, asserting that by storifying no swarms will rise. From long experience, he is certain of the reverse. When duplets or triplets do not swarm, it is not from that cause: it is from abortions of the royal brood, and several other casualties. Nor is there any danger of being over-stocked; for however numerous a stock may be in bees during summer, in winter they will be reduced to a quart. Besides which, bad seasons often happen, and many accidents arise that will require recruiting, and which may be happily effected by forbearing to double a good stock, and a swarm will be the sooner obtained. The following estimate will, he says, show how far the advantage inclines to this method of management:

A Comparative Estimate of Stocks kept in Single Hives, and those placed according to the Storifying Method.

FIRST YEAR.	Dr.		
12 stocks on an average, yielding 15*lbs.* of honey each, is 180*lbs.* at 6*d.*	£.4	10	0
Supposing each hive to have a cast, each of which usually affords 3*lbs.*—36*lbs.* at 6*d.* - - - - -	0	18	0
Wax 1*lb.* each, and 4*oz.* the cast, at 18*d.* - - -	1	2	6
	£.6	10	6
N. B. They are supposed to emit 12 good swarms, to stand for stocks.			
To balance in favour of the story method - - -	2	1	6
	£.8	12	0
Thus, at the end of the year, the stocks will be equal.			

FIRST YEAR.	Cr.		
12 stocks on an average will yield two additional hives of honey, of 16*lbs.* each—384*lbs.* at 6*d.* -	£.9	12	0
Wax, 1½*lb.* each hive -	1	16	0
	£.11	8	0
Discount for the extraordinary expenses, viz.			
24 hives at 14*d.* - -	1	8	0
12 floors - -	0	6	0
24 wooden tops - - -	0	12	0
2 brass plates - -	0	10	0
	£.2	16	0
	£.8	12	0

SECOND YEAR.	Dr.		
12 stocks being the last year's swarms	£.4	10	0
Casts, or small swarms - -	0	18	0
Wax - - - - -	1	2	6
	£.6	10	6
Balance in favour of storifying -	4	17	6
	£.11	8	0

SECOND YEAR.	Cr.		
12 stocks produce as last year -	£.9	12	0
Wax - - -	1	16	0
	£.11	8	0

Hence, says he, it appears, that by laying out two pounds sixteen shillings for the extraordinary apparatus of the first year, a superior profit is to be gained of two pounds one shilling and six-pence. But, in the succeeding years, it will amount to four pounds seventeen shillings, that is about fifty per cent. per annum, on the two pounds sixteen shillings so laid out: or four pounds seventeen shillings and sixpence a year more, gained by storifying twelve stocks, than by a like number in single hives. This statement is made upon the lowest calculation in favour of storifying, which usually yields much more honey and wax than here assigned, and that greatly superior in quality, and consequently more valuable; but which cannot be obtained from common single hives. The instruments are rated higher than what they will usually cost, besides their advantage of durability.

Though he has supposed each common-hived stock to emit a good first swarm, which they often do not, or it is frequently lost, and though some often afford two or three, they in general are but trifling, and abate considerably of the produce of the mother-stock, often to its ruin—what he has allowed for casts, in the common run, will be the full amount. The estimate is founded on the productions of middling situations; but, in better, a single hive may produce a stock of from thirty to forty-six pounds' weight gross; the higher likewise will be the proportional advantage in storifying. Where hives weigh so, they are usually much larger than the general size: and, he thinks, in the single method, no hive should be less than three pecks, or perhaps a bushel, but not more than twelve inches in height. The twelve stocks will require three shillings and sixpence to be laid out in new hives, every third year, which he sets against twelve new hives at least, which must be bought for swarms in the single management. No other branch of husbandry, he is inclined to think, will return so large an interest on so small an expenditure.

Besides the advantages already mentioned, there are others of consequence which deserve notice. 1st. In avoiding the unnecessary and disagreeable trouble in suffocating the bees. 2d. In relieving swarms when too large. 3d. In preventing idleness in their lying out. 4th. In uniting of swarms. 5th. In the means of cleanliness and wholesomeness. 6th. In preserving them from moths, mice, and other insects, by the frequent shifting of the hives. 7th. In giving ample and timely enlargement. 8th. In being provided against

bad seasons. Lastly, in taking but little room in an apiary: as, for instance, four stocks will require no more ground to stand on than they had at first; while common hives will demand twice or thrice as much for swarms, but producing less honey.

The indications for storifying stocks are the appearance of an increase of numbers, and in their activity favoured by the mildness of the season. If the stock be a last year's swarm, set a duplet over it; and as soon as that seems by its weight to be three parts full, set a triplet over the duplet; which last, when full or nearly so, is to be taken off, and probably will be all entire virgin honey, and without bread. Then raise the duplet, or double hive, by placing a triplet under it. But if the strength of the stock is great, and their is plenty of honey pasturage, so that another triplet may be expected to be filled, place the triplet over, instead of that which was taken off. Perhaps, in some good seasons and situations, three or four triplets may be taken, if they are opportunely applied. But if the stock is of two years' standing, it must be raised on a nadir; and as often as it requires enlargement, take the superior hive off, and put a triplet in its place, and proceed thus as occasion may require. These two methods of superhiving the last year's swarm one year, and the next of nadir-hiving the same stock, will be a sure means of obtaining the greatest quantity of virgin-honey, and the largest quantity of the best wax. Observe, in all cases, when hives are set over another, that if the nadir is judged to be about three parts full, the door of it must be stopped, and that of the duplet opened, or the bees will not so soon be tempted to ascend to work in the duplet, nor will this procedure increase the labour of the bees in the meanwhile, as the way down is as short as the way up. On the contrary, when a hive is placed under, the door of it must be stopped for a week or two, or till there is reason to think there are some combs made in it; and then it is to be opened, and in two or three days after shut again, disguising it with a cloth, &c. hung before it for two or three days. Be particularly careful not to let the stocks be crowded, before they are storified.

For if a princess is impregnated early, it may occasion a swarm to rise suddenly: for often great numbers of brood are hatched together, and therefore from want of room become ferocious, and occasion much inconveniency to the apiator and bees; but presently become peaceful and satisfied on enlargement. For an additional hive having communications in direct lines with the combs of the hives added, the bees are led to esteem the whole as one hive in a few days after its application. In some critical days or weeks, when honey-dews are plentiful, or white clover or other pasturage is abundant, the quantity of honey collected in a few days will be almost incredible, if they have room enough to lodge it, filling a hive in seven days: often more than can be accumulated in a whole season. But the advantages arising from additional hives are entirely lost in the old single method. The duplets are in general not to be taken off till late, lest the queen should be therein, or it be mostly filled with brood. But super-triplets may be always taken as soon as filled. Bees never begin to work in an additional hive until new combs are wanted for eggs or honey; and then the bees will begin to hang down in ranges or curtains, which is always a sign they have begun to make combs. Bees often want enlargement before swarm-time; which is denoted by their idly playing about the door and hive. It is the owner's fault and loss if he suffers it to continue. Duplicated boxes will sometimes appear full of combs and bees through the back-windows, though perhaps they are not above a quarter or half filled, the combs being only at the back.

About the tenth of July, the upper doors of all storied stocks should be closed, to induce the queen with more certainty to descend, and breed in the lower hive, except it is designed to be taken; for then the door is to be shut, and the upper one opened. It often happens that in poor situations, or in a long season of very inclement weather, neither duplets nor triplets will have work therein; and this is not imputable to a bad method of management, or want of conduct, but wholly to a failure of the resources of pasturage, or of opportunities to gather it; which sometimes has been so great as to prevent the generality of stocks from procuring a sufficiency for their own winter's supply. It is necessary in summer, when a hive has few bees, to strengthen it with a portion of bees from one that is strong. This will enable the queen to breed fast, and the hive will prove as prosperous as any hive you have. But in all such reinforcements, the hive so replenished should be set at as great a distance as your convenience will allow, for several weeks. This is a rule to be observed in all such cases. Stocks that have emitted swarms can but rarely be expected to yield a duplet that summer, unless the swarm is returned: much less can a swarm do it, though, he says, he has known some exceptions in extraordinary situations. To replenish a stock that is scanty of bees, set some empty combs, and pour the cells of one side full of sugared ale, or platters of it, slightly covering it with a little hay or herbs, to prevent the bees from damaging themselves in it: set it on a hive-floor in the morning, and place an empty hive over it in the midst of an apiary. A great multitude of the bees will be attracted by the odour, and assemble round the feast. As soon as that is perceived, stop the door of the hive until night; when the bees having ascended to the top of the hive, take it and give them a slight fuming, and place them over or under the stock that most wants their assistance. If a queen is killed or dies in the summer, it may be known by the bees not carrying in any farina, or by the door of the queenless stock being much crowded, as well as that to which they carry the honey. Both hives appear prodigiously active, as though a honey-dew had commenced, and with a clear uninterrupted buzz, with crumbs of wax about the door. Immediately stop the door of the unfortunate stock, and unstop it in the evening: the interlopers will then fly home. Early in the morning take the hive to a proper distance, and fume it, or keep them confined till next day in a darkened room. They will then very peaceably and readily quit the hive on a little drumming on the sides. If the hive has much honey, cut the combs out; but take care of those

that have brood, and add them to some other stock. The bees, however, will continue working till all the young are sealed up. If a like accident happen in winter, take the bees out, put them to a stock, and take the honey.

In the want of a hive upon a sudden demand of enlargement, and not having a proper one in readiness, set a common one with bars across it, in a pail or bucket, and place the stock over it; next night close the joining, and at the accustomed time separate it by the dividers, and take the bottom one away. Summers have sometimes been so hot as to soften the combs so much as to tumble them down, occasion the smothering of the bees, and ruin of the stock. To prevent this, in such weather, give them enlargement, and raise single hives behind: screen them as much as possible from the sun, by large boughs, pouring often plenty of water about their hives, and taking off the hackels. Bee-houses should have all their doors set open.

Mr. Wildman recommends the following method of taking the wax and honey without destroying the bees: ——Remove, says he, the hive from which you would take the wax and honey, into a room, into which admit but little light, that it may at first appear to the bees as if it were late in the evening. Gently invert the hive, placing it between the frames of a chair, or other steady support, and cover it with an empty hive, keeping the side next the window of the empty hive raised a little, to give the bees sufficient light to get into it. While you hold the empty hive steadily supported on the edge of the full hive, between your side and your left arm, keep striking with your other hand all round the full hive, from top to bottom, in the manner of beating a drum; so that the bees may be frightened by the continual noise from all quarters, and, in consequence, mount out of the full hive into the empty one. It is to be observed, that the fuller the hive is of bees, the sooner they will have left it. As soon as a number of them have got into the empty hive, it should be raised a little from the full one, that the bees may not continue to run from the one to the other. And as soon as all the bees are out of the full hive, the other, in which the bees are, must be placed on the stand from which the former hive was taken, in order to receive the absent bees as they return from the fields.

If this be done early in the season, the operator should examine the royal cells; for, if any of them contain young bees, they must, as well as all the combs that have young bees in them, be saved in the hive. Take out the other combs with a long, broad, and pliable knife; cutting them from the sides and crown as clean as possible, to save the future labours of the bees, who must lick up the honey spilt, and remove every grain of wax. The sides of the hive should then be scraped with a table-spoon, to clear away what was left by the knife.

Having thus taken the wax and honey, it only remains to return the bees into their old hives; for which purpose let a table, covered with a clean cloth, be placed near the stand, when giving the hive in which the bees are a sudden shake, striking it at the same time pretty forcibly, they will be shaken on the cloth. Put their own hive over them immediately, raised a little on one side, that they may the more easily enter; and, when all are entered, place it on the stand as before. If the hive in which the bees are be turned uppermost, and their own hive placed over it, the bees will immediately ascend into it, especially if the lower sides be struck to alarm them.

Extracting the Honey and Wax.—The next thing necessary to be known is, how to separate the honey from the wax. In order to this, the combs should be laid in a place perfectly secure from the access of bees, otherwise they would not only carry off much honey, but be extremely troublesome by stinging the persons at work. If any bees remain in the combs, they should be brushed off with the wing of a fowl into a tub of water, and afterwards dried and restored to their hives. If the combs are taken out of the hive before the end of autumn, there are generally young bees in them. The parts of the combs in which these are should be laid aside, as they would give a bad taste to the honey. The bee-bread must also be separated, and both should be melted with the wax. Before the combs are laid to drain out their honey, they should be carefully cleaned of every sort of filth, or insects. The crust with which the bees cover the honey in them should then be pared off with a sharp, thin, broad knife, and the combs themselves divided through the middle, in such a manner as to render the cells open at both ends, that the honey may flow the more freely out of them. In this state the combs should be laid on a sieve, or some other contrivance which will afford the honey a free passage. It will run quite clear; and the honey thus obtained should be kept by itself, as being the purest and best.

The combs which are but partly filled, and also those that were full and have done running, are sometimes broken by hand, and the honey squeezed out: and some put the broken combs into a strong bag, and then use a press to squeeze it out; and even warm the broken combs with the help of fire: but neither of these are good, as, in both ways, much of the wax passes through the bag with the honey; and thus the wax, being of greater value than the honey, the owner sustains a loss: besides, his honey becomes the less valuable, in proportion to its being less pure. It is true, however, that a great part of the wax thus mixed with the honey soon rises to the surface, and may be taken off, especially after the honey is grown hard.

Having drained the honey from the combs, boil the fine combs by themselves, with a sufficiency of water to keep them floating, till they are thoroughly melted. A three-cornered bag of strong linen cloth, tapering to a point, is to be prepared, which is to be held by an assistant over a tub of cold water, while the operator pours the melted combs into the bag: instantly draw the top of the bag close by a string, and let two persons press it strongly downwards, between two strong sticks tied together at one end. Do this repeatedly down the sides of the bag, till no more wax issues through. When the wax is cold, it is to be taken from the tub, and re-melted with very little water, merely sufficient to prevent

burning. As it boils, take the scum off as long as any rises, and pour it into proper vessels. Such as are narrower at bottom than top are to be preferred. Rincing the vessels and all the instruments with cold water first prevents the wax from sticking thereto. The vessels or moulds for wax should be placed so as to have the warmth of the fire, with a cloth over them, that the wax may cool gradually, or it will crack. When quite cold, turn out the cakes of wax, and pare off all the dregs that may appear on the top or bottom, that it may be clear and marketable. The dregs that are pared off may be re-melted, and will yield a little more wax. Instead of persons to hold the bag, which is fatiguing, it may be slung upon a strong staff, with the ends resting on the back of two chairs. Or a four-legged frame might be more eligible, high and wide enough to admit a tub of water in the inside; and with strong pegs fixed on the top, at proper distances, for sustaining the bag in the middle of the frame. The bag is to have a running-string to draw the mouth together. The vessels in which wax is boiled ought always to be considerably larger than the matter contained; for when the wax boils, it very suddenly rises to a great height, and may otherwise prove dangerous.

It has been found, that the larger the cakes of wax are, the better the wax keeps, and the higher price it brings; and that the more gently it has been boiled the better it is, as too hasty boiling renders it hard, and increases the difficulty in bleaching it.

A more expeditious method of extracting the wax from fine combs is, by boiling them alone. Press them slightly down, use very little water, keep them stirring till the scum rises, which take off as long as any rises; but when only froth appears, blow that aside. When perfectly dissolved, pour it into proper moulds, and set it near the fire, covered over till cold. On turning it out, the small quantity of impurities which has subsided to the bottom is to be pared off. If the cake of wax should by chance seem discoloured, re-boil it without water. Wax, when taken off the fire, cools nearly as soon as metals; therefore the process should be executed as expeditiously as possible, or a less quantity of wax will pass through the strainers.

If combs are kept a considerable time without being melted, they will moulder and rot, or the wax-moth will breed among them, and devour the greatest part, and pester the whole apiary. A hive of three pecks, well filled with full honey-combs, of two years' standing, will yield in general twenty-five pounds of honey, and not more than two pounds of wax. The average run of common hives is fifteen pounds of honey, and one pound of wax.

The goodness and flavour of honey depend on the fragrance of the plants from which the bees collect it: and hence it is that the honey of different places is held in different degrees of estimation. That which has been collected from aromatic plants is said to be the best. Mr. Marshall, in his Rural Œconomy of Norfolk, doubts the bad effect of buck on honey, notwithstanding the present received opinion; and thinks that the inferior quality of honey produced in that county may be attributed to heath, which is well known to afford much honey, but of an inferior quality. This he remarks also in his Rural Œconomy of Yorkshire, which he says may be called a bee-county, especially the Morelands and the northern margin of the Vale, where great numbers of bees have been usually kept, and great quantities of honey collected, chiefly from the flowers of heath, which afford an abundant supply; but the produce is of an inferior quality, brown, and strongly flavoured. In hives situated between the heaths and the cultivated country, a striking contrast is observable between the spring and the autumnal combs. The former gathered wholly from the meadows, pasture-lands, trees, and cultivated crops; the latter entirely from the flowers of the heath, none of the species of which begin to blow until late in the summer. The combs of the former are nearly white as snow, and the honey limpid almost as the purest oil: those of the latter brown, and the honey they yield of the colour and consistency of melted resin. This difference is most striking when the hive is carried in autumn, from the lower parts of the marginal heights into the Moreland-dales, to be filled up with honey; a practice which, singular as it may appear, has been followed with success. It is probable that as this sort of stock requires but little capital, is fed almost without expense, and demands scarcely any attention in its management, it may be found advantageous in many situations for the farmer not to overlook it.

Mr. Young thinks, that bees are not so much attended to by farmers as they ought; as no farm-house should, in his opinion, be without hives of these useful insects, as they require little trouble, and small profits should not be despised or neglected.

It has been suggested, in the Bibliotheque Physico-Economique, by Mr. Lombard, that vinegar may be made from the refuse of bee-hives, after the honey and wax have been extracted from the combs, by breaking and separating the remaining mass, and putting two parts of water to one of it, exposing the whole to the influence of the sun, or in a warm place, having it covered close, so that fermentation may take place in a due degree, stirring the mixture frequently. When this has been effected, the whole should be strained, the yellow liquor at the bottom of the vessel being thrown away. The vessel being then washed, and the filtered water put into it, it soon becomes sour, being covered and kept in a proper state of warmth; and, after remaining a month or six weeks, may be put into a cask, keeping the bung-hole open. It is used as common vinegar.

Bee-*Hives*.—The author of the Ancient Bee-Master's Farewell, thinks that straw is the best material for hives, as protecting the bees the most perfectly in the extremes of cold and heat, and being also generally easiest to be procured. Where it is not so, rushes, wicker-work plastered over, or sedges may be substituted in its stead. For this use, unthreshed straw should always be employed, of all kinds of which that of rye is to be preferred, as threshing shivers and makes it rough and shaggy, which the bees with much labour are obliged to gnaw off. His hive-maker, he

says, laying the straw in a chaff-box, readily cuts off the ears, and thus prepares it for use.

Bee-hives have been constructed in different ways; those which were formerly much employed, and are at present frequently met with, had flattish conic tops; but by some, these kinds are not thought so good.

The practical writer we have just quoted, proposes three hives to each stock; and the size he has found most convenient, is that of half a bushel: larger, he says, are very inconvenient to manage; while these, by storifying, give ample room for all that the bees can want, at the same time admitting triplets to be taken off the sooner. They should be made nine inches high, and twelve wide, in the clear, on the inside, exclusive of the top, as in *pl.* IX. *fig.* 3. The body is to have no straw-top fixed, or worked to it, as in common, but is to be a separate piece. This part of the hive, therefore, resembles a broad hoop; and, like that, must be perpendicular, or straight down; and not one part swelling, or being wider than another. The straw cover is to be made quite flat, like a round mat, but wide enough to extend an inch beyond the edge of the hive. There needs only one cover to three hives. The greatest proof of the maker's skill will consist in his exactly following the prescribed dimensions, and in the evenness of his work; particularly in both edges, that they may admit of one hive being set on another, without any chasms, and that promiscuously, or hab-nab. In one of the edges, a distance of full three inches is to be left, free of binding, for a door-way. But a more proper one may be formed by a small piece of wood, four or five inches long, in which a door-way is to be cut, of three inches long, and three-eighths of an inch in height, and worked into the round of straw. Or, what will be still better, is to take a rod of willow or hazel, while green, and bend it to a circle of a proper size for the hive. When it is wanted, reduce it so as to have two flat and even sides; cut a proper door-way out, and burn holes at due distances to receive the brier binding, by which the first round of straw is to be fastened to it. If the binding is carried wholly round the hoop, the binding will be soon rotted by the wet, and prove of little more service than if there had been none; but otherwise it will preserve the hive much longer, and be more convenient in many respects. As soon as hives are made, they should be set separately on level boards, or the like, and have heavy stones laid on them; but first a person should jump upon the boards, to reduce the edges to a proper evenness. This practice must not be neglected.

Besides the flat straw cover, all the hives must have wooden tops, as in *pl.* IX. *fig.* 6; to make which, procure a board of the width of the hive, and half an inch thick, free from knobs. Seven or eight spaces or openings are to be cut, *b b b b b b b*, each exactly half an inch wide; the length of the three innermost eleven inches, the two next nine, and the two outermost six inches. The carpenter must be attentive not to deviate from these directions in the smallest degree, as a trifling neglect will render the whole useless. In case boards of a proper width are not to be had, one ten inches wide may be substituted, brading circular pieces on the sides after the top is cut out, to fill up the deficiency. Round the edges, a hoop of tin or slight ozier must be tacked to strengthen it, and prevent its splitting. A long brad or peg should pass through the fore and hind parts, and enter the edge of the hive, to keep the top from being displaced; taking care that the heads of the brads are driven rather below the surface of the wood.

A cheaper top may be made of narrow slips of wood or bars, six in number, as in *pl.* IX. *fig.* 3, *a a a a a a*, designed to be laid across the top of the hive, at half an inch distance from each other; the two outermost bars to be one inch and a quarter wide, and the others one inch and a half. Two slips of wood, *b b*, an inch wide, are to be braded across the bars withinside, or rather let in, to be flush on both sides, near the ends, to fasten them together, and to keep them at their due distance. The cross-pieces will thus be below the edge of the hive, while the ends rest on it. But since the breadth of this frame of bars will not be quite that of the hive, the deficiency must be supplied by two small circular pieces braded on the edge of the hive, leaving two half-inch openings between them and the bars. As the ends of the bars, when laid on the hive, will leave vacancies between, these must be stopped by cow-dung of a due temper, which, when dry, will be sufficiently tenacious. Take care that the whole top be even and smooth. It should be laid on always in the direction of front and back.

The straw covers are to be fastened on by loops of cord, or rather leathern thongs, passed within, at about two inches below the top of the hive. They are to be four in number, placed at equal distances, and a cord to each pair, to draw them tight over the top.

The hive-floors should be one inch thick, of yellow deal planed on one side only, truly level, and of sixteen inches diameter. Where boards of that width are not easily to be procured, an additional piece must be rabbeted and doweled to it. Two cross-pieces are to be nailed underneath, to strengthen and prevent its warping; or rather they should be nailed upon the ends. Three of the corners may be cut off, leaving the fourth for a place to alight on. One floor only is requisite to every three hives; but two or three spare ones will be convenient on many occasions.

Cottagers may contrive tops from those cuttings of trees which are straight, of an equal thickness, and of a length as above described. These, while green, may be easily cut flat, with a knife, of the proper measure, by first laying them over the top of the hive, at the distance of half an inch from each other; they may then be marked, and cut to their just length. Two pieces are to be braded under their ends, so as not to prevent the cross-pieces from sinking into the inside; and to hold the bars steady, without sliding backward or forward. The vacancies between the bars on the edge of the hive are to be filled up with cow-dung, which, when dry, as has been observed, will be sufficiently tenacious. Care should be taken to make every part of the top smooth and level; which, if not so, reduce it by laying heavy weights thereon.

There are other sorts of hives in use, which answer very well, as may be seen in *pl.* IX. *fig.* 18. And be-

sides these sorts of hives, others of the dioptrical kind, constructed in different ways, so as to exhibit the bees at work, are in use; such as are represented in the annexed plate at *fig*. 2, 4, and 7; in the first of which *a a a a a a* are cross-bars, *d* glass front: *fig*. 5, is a floor-board. Hives of the first sort require hackels or coppets, which, Mr. Keys says, are best made of wheaten straw. The method is this: Take a sheaf, bind it with a cord ten or twelve inches below the ears; with the left hand gripe a small parcel or locket, of about sixty straws, of the part above the cord, and with the other hand a like locket, and, giving it a twist round the first locket, bring it down close to the cord, pulling the other locket straight down. Take a third locket, and twist over the preceding; and thus continue to twist and turn down until the whole is finished, except three locks, one of which is to be brought between the other two, which are to be tied in a knot over it. Then, reducing the whole as flat as can be, run a short forked stick through the knot, to prevent its starting. The hackel may thus be made in about twenty minutes. This form is the best suited to the purpose of any that he has seen; they sit close to the top of the hives, keeping them warmer and drier, which is of great advantage in winter and spring. Neither are they so liable to be blown off. The part before the doors should be clipped so as to admit the sun's rays. For fear of storms, a hoop may be thrown over them, and fastened by two strong sticks with crooks at their ends, and thrust into the ground on each side. This will be a good security at all times.

And he adds, that by placing the hives at the distance stated below, they will preserve the bees from quarrelling, or emigrating from one hive to another. Opulent persons, to whom the appearance of straw hives may seem inelegant, might have them concealed from view by such shrubs as are of service to the bees, planted at such a distance as not to intercept the sunshine to the front of the hives. Or handsome covers, something in the shape of hackels, terminating in a point at top, and painted, would have a pleasing appearance. Or a screen in perspective, of rocks or ruins, &c. with proper openings for the bees to issue from behind, on floors properly disposed, on which they should be placed as in a bee-house. Mr. Bonnor has found coarse brown earthen pot-tops to answer very well, and to be at the same time cheap.

Bee-*Stands*, the benches, stands, or houses, which support and contain the hive or boxes in which the bees prepare their honey and wax. In respect to bee-stands, Mr. Keys thinks that it is very wrong to place hives on benches, as it is always the source of mistakes, quarrels, and often slaughter, by their interference with one another. And a still worse contrivance, says he, is that of little cots or sheds, with shelves therein one above another, as affording a greater harbour for their enemies, and being very inconvenient for the manager, and indeed incapable of admitting the story method of management.

The arrangement which he recommends, is that of separate stands for each hive, made by driving four strong stakes into the ground, at equal distances, as thus, : : corresponding to the dimensions of the hive-floors to rest thereon: they should be sixteen inches above the earth, and the tops upon a level with each other.

The stands should be three or four feet distant from one another, and from any wall or fence, in uniform rows, for the apiator's conveniency of managing each stock; the hives should not be set higher than sixteen inches, in the story method, as their height would be attended with many difficulties. Where persons have many stocks, he thinks it better to divide them into several gardens, as when too numerous in one it frequently occasions quarrels: eight or ten in one place are sufficient.

In every case, the bee-stands should be very well secured from the danger of being thrown down by high winds or other causes. Different sorts of stands have been represented above; and in the annexed, at A, *fig*. 1, is another, *b b b* uprights, *c c* top, and *a a a* entrances for the bees.

Diseases of Bees.—Cold, foggy, damp, weather, in the winter, Mr. Keys observes, is very often fatal to bees; for then, having no exercise, they become subject to a purging, by which they are soon reduced very weak; and, clustering together in a body, soil each other, and thus contaminate the whole. The signs of this disease are, small crumbs of wax about the door or on the floor, with many dead bees, and much filth caked together, and, if of some time standing, mouldy, often concealing destructive wax-moths, &c. If the bees do not fly out, and appear as active as other stocks, it is a symptom that they are either dead or starving.

The diseased stocks are to be taken, as soon as discovered, into a warm room. The foulness from the edges of the combs should be brushed away, cutting out the parts that are mouldy or black. Set the hive at a moderate distance from the fire, which will revive the bees that are feeble or torpid. As soon as they begin to move, pass among them a few drops of honeyed ale; tie a slight cloth over the hive, that none may crawl out, and let it remain three or four hours, to purify the damp and foul exhalations. When the bees are pretty well recovered, give them a trough of honeyed ale, in which the leaves of rosemary have been infused, and set the hive on a clean floor. Contract the door so as to admit a little of the warm air. Let them remain till next day. If then the bees are few, or are still weakly, cover a dry floor with ashes, place on that a little hay or straw, and set the hive therein, conveying it to its usual stand. Cover it well with straw, rags, &c. and notice occasionally whether their condition may require further feeding; which should be given daily, if the hive is not sufficiently stored with honey and farina. When bees fall motionless to the bottom of the hive, it indicates that they are chilled with cold, or in a starving condition. To prevent a further destruction, treat them as above, or set them to a plentiful stock. Bees often fly in a desultory manner about the hives, bee-houses, or dwelling-house, in the spring, with lamenting tones, as though wanting something: that something is food, for they are almost famished. By observing which of the stocks has an unusual crowd at their door, the distressed hive may be discovered. A fresh, dry, and warm floor must be given them, and they must be immediately fed: the delay of a day may be a day too late.

In order to secure bees from diseases, he says, it will be necessary (contrary to the common opinion) to keep the hives warm in winter, by filling the vacancies around and at top of the hives with straw, especially box-hives. In snowy weather, or very hard frost, the door-ways should be wholly closed, which in such a season will not be prejudicial; provided care is taken to unstop them immediately on the weather changing; for, as soon as that happens, they will be very anxious to issue out for fresh air, as also to empty themselves. Bees should always be suffered to make their exit, except as above, as they well know what weather they can bear, and how long to stay in it. It is best not to house bees in winter: for when a mild day comes, they will rejoice to take the air, which contributes much to preserve them in health. In winter, they should be disturbed as little as possible. When bees are long confined by severe frost, or rainy weather, though in summer, they grow diseased for want of exercise, and for want of emptying themselves. The regulation of the doors of the hives should be proportionate to the weather and the populousness of the hives. The warmer the hives are kept the better. In cold springs the doors should be shut at night, and opened in the morning.

BEE-SUCKEN, a term applied to the ash, when its bark is in a black, cankerous, and turgid condition.

BEECH, the name of a well-known tree, of which some planters suppose there are two distinct species: one denominated mountain or wild beech, and the other common beech. It is also said, that the wood of the former is whiter than that of the latter. Mr. Miller, however, assures us, that there is only one species of this tree, and that the difference in the colour of the wood arises from the difference in the soils.

This tree is propagated by sowing the mast, which may be done at any time from October to February, only observing to secure the seeds from vermin when early sown; and, if this be carefully done, the sooner they are sown after they are fully ripe the better: a small spot of ground will be sufficient for raising a great number of these trees from seed; for when the plants come up very thick, the strongest of them should be drawn out the autumn following, that those left may have room to grow; so that a seed-bed, carefully managed, will afford a three year's draught of young plants, which should be planted out in a nursery, and, if designed for timber-trees, at three feet distant row from row, and eighteen inches asunder in the rows. But if they be designed for hedges, a purpose for which the tree is very well adapted, especially in exposed situations, the distance need not be so great: two feet row from row, and one foot in the rows, will be sufficient. In this nursery they may remain two or three years, observing to dig up the ground between the roots, at least once a year, that their tender roots may the better extend themselves every way: but be careful not to cut or bruise their roots, which is injurious to all young trees; nor should the ground be dug round them in summer, when the earth is hot and dry, as, by the evaporation of the little moisture that remains in the soil, the young trees are often destroyed.

This tree will grow to a considerable stature, though the soil be stony and barren, as also upon the declivities of hills and chalky mountains, where it will resist the wind better than most other trees; but in these cases the nurseries for the young trees ought to be made upon the same soil; for, if they are raised on good ground, and in a warm exposure, and afterwards transplanted into bleak barren situations, they seldom thrive well. The nursery should therefore be made upon the same soil where the plantation is intended, and the plants drawn annually to extend the plantation. This tree is very proper to form large hedges to surround plantations or wilderness quarters in pleasure-grounds, and may be kept in a regular figure if cut twice a year, especially where they shoot strong; in which case, if they are neglected but a season or two, it will be very difficult to reduce them again. The shade of this tree is very injurious to most sorts of plants which grow near it, but is generally believed to be salubrious to human bodies.

Beech delights in a chalky or stony ground, where it generally grows very fast. Mr. Nicol, however, found it in the greatest perfection in light, deep, chalky, or sandy loams. And, on all soils, except a stubborn clay or a retentive sub-stratum, it becomes, he says, a graceful tree of a great stature. He asserts, that even among rocks, where there is scarcely any soil visible, it arises to a great magnitude. In all calcareous soils, it flourishes much. The bark of the trees in the first kind of land is generally clear and smooth; and although the timber is not so valuable as that of many other trees, yet as it will thrive on such soils, and in such situations where few better trees will grow, the planting of trees of this sort should be encouraged, especially as they afford an agreeable shade, and the leaves make a fine appearance in summer, and continue green as long in autumn as any of the deciduous trees; consequently, in parks, and other plantations for pleasure, this tree deserves to be cultivated among those of the first class, especially where the soil is adapted to it.

The timber of this tree, though not in general highly esteemed, is, however, of great use to turners for making trenchers, dishes, trays, &c. and also to carpenters for making stools, bedsteads, &c. and it will last a long time when made use of under water. Shipwrights likewise often use it for the keels of ships; and it is esteemed the best wood of any for firing. The thin lamina, or scale of wood, commonly called pasteboard, used in making band-boxes, hat-cases, &c. is of this sort of wood.

This kind of wood is well known to be subject to worms, which soon destroy it. They are supposed to feed upon the sap remaining in the wood after it is cut into scantlings, and worked up for use. If therefore the sap can by any means be extracted, the wood will be much less subject to decay. Upon this principle the wood is greatly improved by laying it a reasonable time in a pond, and afterwards drying it in the shade; by which means the timber, when applied to use, becomes at least as good and as durable as elm. It has also been found, that by boiling the wood intended for smaller works, such as bowls, trenchers, chairs, &c. two or three hours in a copper filled with water,

all the sap may be extracted, the wood works pleasanter, be more beautiful when finished, and last longer. It is highly useful in ship-building, and in the constructing of waggon-ways in collaries; as well as for different purposes of husbandry and mechanical uses.

Beech-*Mast*, the seed of the beech-tree. It is esteemed very good for feeding swine in some places; and where there are large woods of beech-trees, the hogs are fed for months together on it alone. They are said to thrive prodigiously on this kind of food, and a great number of porkers are often killed in a short space of time fatted with beech-mast, without the assistance of any other sustenance. It is, however, the better way to take them up, and give them either pollard, barley-meal, or peas, for a month or five weeks, when they will be fit for the salting-tub.

Beech-mast, like acorns, are however apt to give the hogs a distemper called the garget; but which may frequently be effectually prevented, if they be kept sufficiently open in their bowels; or if a few peas or beans, moistened with water, and sprinkled over with antimony finely powdered, be given them every day for a fortnight or three weeks.

BEELD, a term provincially applied to any thing which affords shelter, such as a clump or screen of trees, planted for the protection of live-stock of any kind.

BEER, a spirituous liquor that may be prepared from any of the farinaceous grains, but for which barley is most commonly employed.

It is, properly speaking, the wine of barley. The meals of any of these grains being extracted by a sufficient quantity of water, and remaining at rest in a degree of heat requisite for the spirituous fermentation, naturally undergo this fermentation, and are changed into a vinous liquor. But as all these matters render the water mucilaginous, fermentation proceeds slowly and imperfectly in such liquors. On the other hand, if the quantity of farinaceous matter be so diminished that its extract or decoction may have a convenient degree of fluidity, this liquor will be impregnated with so small a quantity of fermentable matter, that the beer or wine of the grain will be too weak, and have too little taste.

These inconveniences are therefore remedied by preliminary operations which the grain is made to undergo. These preparations consist in steeping it in cold water, that it may soak and swell to a certain degree; and in laying it in a heap with a suitable degree of heat, by means of which, and of the imbibed moisture, a germination begins, which is to be stopped by a quick drying, as soon as the bud shows itself. To accelerate this drying, and to prevent the farther vegetation of the grain, which would impair its saccharine qualities, the grain is slightly roasted, by means of a kiln, or making it pass down an inclined canal sufficiently heated. This germination, and this slight roasting, change considerably the nature of the mucilaginous fermentable matter of the grain. The germination attenuates much, and in some measure totally destroys the viscosity of the mucilage; and it does this, when not carried too far, without depriving the grain of any of its disposition to ferment. On the contrary, it changes the grain into a saccharine substance, as may be perceived by mashing grains beginning to germinate. The slight roasting contributes also to attenuate the mucilaginous fermentable matter of the grain. When the grain is thus prepared, it is fit to be ground, and to impregnate water with much of its substance without forming a gluey or viscous mass. The grain thus prepared is called malt. This malt is then to be ground; and all its substance, which is fermentable and soluble in water, is to be extricated by means of hot water. This extract or infusion is sufficiently evaporated by boiling in caldrons; and some plant of an agreeable bitterness, such as hops, is at that time added, to heighten the taste of the beer, and to render it capable of being longer preserved. Lastly, this liquor is put into casks, and allowed to ferment: nature performs the rest of the work, and is only to be assisted. See *Brewing*.

BEES-NEST, a term sometimes provincially applied to the wild-carrot. See *Wild Carrot*. It is sometimes written *Birds-Nest*.

BEESTINGS, the first milk taken from cows after calving, which is of a thick consistence, and yellow colour. This milk should in part be taken away from the cow upon her first calving, as when taken in too large a quantity by the calf, it may prove too purgative, and consequently injurious.

BEET, a luxuriant, free-growing plant, which, both in its root and its leaves, contains much saccharine nutritious matter, and of which there are several varieties cultivated in gardens.

White Beet. This kind, from the quickness of its growth, when cultivated in a rich and suitable soil, and from its containing a large proportion of saccharine matter, might probably be employed with advantage in the feeding of some sorts of domestic animals. Both the leaves and the roots might be made use of for this purpose. This plant has not, however, we believe, yet been much attended to as an article of food for cattle or other animals. See *Mangle Wurzel*.

BEETING, a term applied in planting to the filling up the vacancies produced by the death or destruction of such trees as has been first planted out, in order that there may be an equal regular crop upon the ground. This is a business that should always be attended to as soon as possible; though, by a too implicit regard to it, without proper caution, much debility, and thousands of trees may be lost and destroyed; as it very frequently happens that two plants rise nearly together.

"To plant this year, and beet the next," says Mr. Nicol, "borders on folly; unless the ground be kept clean with the hoe, or that the place of every tree be distinguished, so as to ascertain whether it be dead or alive." And he conceives, that "this alone is a sufficient reason for keeping the pits clear, as above, on all rough surfaces. Nor would the expense, in general, equal that of putting in unnecessary plants, independent of the advantage the crop would reap by being kept clear." However, where this is not the case, and in all instances of slit-planting, the third or fourth year should arrive before a general revision or beeting takes place. By this time, the plants will be, visibly, either in a dead or flourishing state: for it frequently happens that many of the deciduous kinds, particularly if placed in a bleak situation, or if the

first summer prove dry, will die down to the ground, push weakly the second season, and vigorously the third. By this time, also, the sown oaks, where they have been thus put in, will have made their appearance, and, perhaps, supplied the place of many dead plants. However, by the fourth year, the plantation should be gone over and filled up, that the crop may rise regularly in all parts, and that the beeted plants be not drawn up too weak, or be choaked by the others. The same writer likewise adds, that he "cannot avoid remarking the almost universal error which prevails in beeting with large plants, in all cases, that the plantation may more immediately appear complete. Could we, says he, stifle prejudice, and appeal to impartiality, nor close our eyes from the light which so forcibly beams upon them, we would at once discover, that this, namely, planting large plants, not only chiefly occasions beeting at all, but, in this case, renders it necessary for many successive years." It is further stated, that beeting each season for a number of seasons is requisite in cold exposed situations, where narrow stripes are only planted, until the plants attain sufficient strength, and afford each other shelter, which is not the case in more extensive plantations.

When properly attended to and performed, this business is however essential, as without it there must be considerable loss in the land not being fully covered; and besides, the plantations will have an irregular disagreeable appearance. See *Planting Timber-Trees.*

BEETLE, the name of an insect, of which there are a great variety of species, all of which have cases over their wings to defend them from hard bodies, which they may meet with in digging holes in the ground, or gnawing rotten wood with their teeth, to make themselves houses or nests. When they fly, they fill the air with a humming noise, perhaps greater than that of any other sorts of insects. There are some beetles of a large size with horns, and others small, and without horns. These animals are extremely destructive to many sorts of crops, and should of course be destroyed as much as possible.

Beetle, a wooden instrument in the form of a mallet, but much larger, used in driving piles, wedges, hedge-stakes, and in splitting wood, &c.

Clodding-Beetle, a sort of implement made use of in reducing the lumpiness of tillage-lands to a fine powdery condition. See *Clodding-Beetle.*

BEEVES, a general name employed by farmers for oxen or black cattle.

BEHEN, a species of chickweed, frequently called spattling-poppy. See *Chickweed.*

BELT, a term often applied to a narrow strip of leather.

To *belt* also, in some districts, signifies to shear the buttocks and tails of sheep.

Belt, of *planting*, a stripe or portion of land planted with trees round some field or other extensive ground, for the purpose of ornament, or the affording due warmth and shelter. Much advantage may be derived in this way in altering and improving the climate of the situation in which it is performed upon.

It is observed by Mr. Nicol, in his practical work on planting, that the benefits to "be derived by subdividing extended tracts of sterile, exposed land, with stripes of planting, are manifestly great; whether we view them in the light of affording immediate shelter to the lands, or in that of improving the surrounding climate. To all pasture-lands, widely extended on open plains, the advantages arising from being properly subdivided by belts of growing timber, are both obvious and great."

It is, however, remarked by Mr. Somerville, in the second volume of Communications to the Board of Agriculture, that "in exposed situations it is strikingly useful and ornamental, while, upon the low grounds it is not only unnecessary, but in some instances absolutely hurtful. For instance, says he, in deep and broad valleys surrounded by hills, and sheltered from severe blasts, belts of planting are not only unnecessary, but even hurtful and ruinous by the ground they occupy, which could certainly be employed to greater advantage, and the original expense of planting be saved. There are other situations, however, where, though the lands are very flat, and the soil good, yet, from the want of hills and high grounds in the neighbourhood, they are so much exposed to the sea blasts and a current of air, passing over a great extent of country without any interruption, that the value of the soil is thereby very much diminished. The peninsula which forms the county of Caithness, in Scotland, is, he says, a striking proof of this: with a soil of a very good quality, and highly improvable, its value is greatly impaired, by the circumstance of its being so much exposed to sea winds, which coming from a very inauspicious quarter, and blowing over a considerable extent of country without meeting with any obstacle to break the force, or change their direction, blow with uncommon severity and fierceness, and in that way are an effectual check to vegetation. There are very extensive tracts in England in nearly the same situation, the whole of which might, he thinks, at small expense be sheltered, and rendered completely productive, by intersecting the country in a judicious manner with plantations and hedges, either separately or conjoined, as in the hedge, and belt of planting."

The former of these writers further remarks, that "the health of the animal, as well as of the vegetable kingdom, is improvable by the aid of shelter and genial warmth. In congenial soils, plants are made to flourish:—if aided by genial warmth—in a superlative degree. Who, says he, at all conversant in rural affairs, does not know that the pasture-field, which is either naturally sheltered, or sheltered by plantations, is prized higher than that unsheltered, although the soil be equally good, or even superior in quality? If we enquire into the cause, it will, he thinks, be found not only to depend on an early rise of herbage, by means of the shelter afforded to the lands; but also, that cattle, who have it in their choice, in cold seasons, to indulge in the kindly shelter afforded them by trees, feed the better. Nay, we may, says he, safely presume, that no animal can fatten in discontent, or in an uncomfortable condition. That the kindly shelter, and also the kindly shade of trees, are comfortable to pasturing flocks, may be demonstrated by

watching their movements—in the stormy blast—under a scorching sun. How keenly will they fly to the shelter! How anxiously will they court the shade! No doubt, continues he, from smothering up small fields, already comfortably situated in point of climate and shelter, with close plantations, there can few advantages proceed, especially while the fields are under corn-crops. But, what relation has this to reducing widely extended, bleak tracts, into commodious compartments, whether of corn or pasture-lands? It may be argued, that even the desirable or salutary effects of shelter may be produced, by simply planting single rows of trees around the inclosures. Granted, in many cases. But, in bleak, unsheltered situations, single rows are reared with much uncertainty of success. But, by planting a stripe of moderate breadth, even on good land, is there, he asks, an inch of ground wasted? What crops would ultimately pay better? Moreover, might not the margin of the field be as much shaded by the tops, or impoverished by the roots of a single row, as by a stripe of any given breadth? Might not the trees in a single row, become as tall as those in a broad stripe? and, might not their roots shoot as far into the field, as those in the outmost row of a belt?"

It is farther observed, that "for improving the climate of bleak, barren, extended plains; next to, or rather in conjunction with a rational culture of the ground, nothing can be more advantageous than the judicious disposal of plantations, generally denominated stripes or belts. On more varied surfaces, the disposition of these, together with clumps of different shapes, as may best suit the situation in point, will frequently be found tending to this desirable purpose, namely, improving the climate; more especially, if skill be displayed in the disposition." And it is supposed that "the good effects of shelter thus afforded will soon be visible, not only on the immediate, but on the more remotely-situated lands. Wherefore, in the disposition, it becomes a matter of consideration, to place the clump, stripe, &c. so as to answer a two-fold purpose, if conveniency will permit. In many cases, according to situation, waste corners may be turned to advantage in this point of view, without encroaching much on the adjacent arable lands: perhaps only as far as to afford good hedge-fences, by touching on the better margins of the tilled ground; or, in order to render the whole more agreeable to the eye, embracing part of a jutting angle, segment, &c. In cases, which are not unfrequent, where the surface is broken by crags, rocks, abrupt ridges, &c. it would, he thinks, certainly tend to the advantage of the estate, more than any other mode of culture, to plant such with timber-trees; independent of the benefit the neighbouring lands would afterwards reap, from the kindly shelter or shade of the plants." And that "in others, where the surface is broken by coal, lime, or iron mines, quarries, &c. and where the expense of levelling and reducing it into arable land might be great, it may be found more advantageous to plant as above; keeping the double purpose of affording shelter to the adjacent grounds in view." Also "in others, where the surface is broken by water-runs, pools, marshes, &c. to plant their margins, will frequently, it is imagined, be found to tend to the advantage of the neighbouring lands, and afford the beholder much pleasure and satisfaction in the effect which it produces in altering the appearance of the district or country."

In regard to the direction and position of the belts and stripes, they "may, he says, frequently be regulated by arbitrary circumstances; as, the limits or boundary of an estate, the position of public roads, the course of a river, ravines or chasms, abrupt precipices, &c." But, "where this is not the case, and where the choice is unrestrained, the leading points for consideration are, 1st. By what position the stripe or clump may have the best effect in opposing the wind; being placed in its eye, by observation of from what point, and with what effect, it generally blows. 2dly, By what position and direction it would most effectually answer the two-fold purpose of sheltering, and conveniently dividing the lands in question. 3dly, In what position a belting might be run along, or near to the conjunction of tillable and untillable lands, so as to impair the one as little as possible, and at the same time, improve the other by the shelter afforded to its flocks. 4thly, In what position a stripe might be run through pasture-lands, so as effectually to afford shelter, shade, and entice the flocks naturally to fold and rest, where their dung might either be collected for removal, or, being let remain, might be washed downwards by rains, to the improvement of the inferior surface of the field. 5thly, Supposing two contiguous estates, whose owners are mutually anxious to improve or adorn their respective confines: By what position and direction a belting might be run or produced, so as to improve or adorn the one, without injuring or disfiguring the other, reciprocally, in its progress or extension. And 6thly, By what position or direction a clump or stripe might most effectually be run, with the double view of covering a disagreeable object, and improving the circumjacent lands."

It is added, that "these considerations may be found serviceable in many cases, in determining the position and direction of useful stripes, clumps, &c. But it is obvious, that no fixed rule or regulation can be laid down. An infinite variety of surface, situation, and exposure, prevents the possibility. Let us hope, says he, no one would place a clump, or run a stripe at random, without considering—of its use in the first instance—of its value afterwards. The breadth of stripes, and the volume and extent of clumps, according to local circumstances, may, however, be determined. Here he means useful, not decorative stripes, &c. but such as are run, or placed with the intention of affording shelter to lands, which, by these means, may be rendered more valuable. How often, says he, we find this laudable intention rendered futile through niggardliness and inadvertency! Though we have to lament the latter, we cannot help condemning the former. To run a narrow stripe, perhaps of four or five yards in breadth, through an exposed, barren tract, is, indeed, better than to plant a single row; but a single row, in a sheltered situation, may rise sooner, and more effectually afford shelter, than a stripe of this description, in a bleak exposure." Of course "before proceeding to mark off the breadth of stripes,

or to delineate clumps with this view, the situation, in conjunction with the quality of the soil, should, he thinks, be duly considered."

It is supposed, that "if the site is much elevated, the soil poor, and the climate unfavourable, the stripe or belt should not be made less than sixty or seventy yards in breadth. Nor should the mean diameter of the clump, provided it lie somewhat regular, and in a mass, be made less than double that breadth, viz. from a hundred and twenty to a hundred and fifty yards. In more favourable situations, with a better soil, the breadth of stripes or belts may be reduced to about forty yards; and the mean diameter of clumps, to about an hundred. But in no situation whatever, in the present point of view, should stripes be under twenty yards in breadth. Clumps or masses of planting, under an hundred yards mean diameter, are trifling and diminutive, and not worth the fencing-in. In the present point of view, we are, he says, to consider, not only the value of quickly rising shelter, but also that of useful timber at a future period. Else, why should we bestow the expense of fencing, independent of that of planting and necessary culture? By planting narrow stripes or diminutive masses, the proportional expense of fencing, and also that of future culture, is, he conceives, much encreased." And besides has much disadvantage in the beeting which is necessary afterwards, &c. See *Beeting*.

Mr. Somerville thinks, that where they are intended as durable fences, "from forty to sixty feet is the very least breadth that should be allowed; and in cases where the situation is very elevated, and the intrinsic value of the soil small, the belts should be three times that breadth: such a space will allow abundant room for planting such a number of trees as will, by the mutual shelter which they afford to each other, promote their growth, and protect them against the blasts which are so severely felt in those elevated regions." And "the more effectually to promote the desirable purpose of sheltering the young trees, they should be planted very thick; perhaps, four or five times the number that is meant to be allowed to grow to the full size, should be planted. The expense of the plants, in the first instance, will be very trifling, and much more than repaid, by the value of the weedings, after they have attained a certain age; with this additional benefit, that the whole plantation will grow faster, and in that way sooner answer the purpose of sheltering the lands. Planting an extra number of trees is also, he says, beneficial in another point of view, namely, that of affording a choice of the most healthy plants to be left, when the plantation is thinned."

It is farther remarked by the same writer that, "where belts of planting are made, it is common to have two sets of trees, one of firs, pines, or larches, and another of oaks, ashes, and other hard woods; the first set is generally meant to shelter the second, and nurse them till they arrive at a certain age and size, when the first set is cut down. In some instances this mode, he says, answers extremely well, but in a multitude of cases it is otherwise; the firs, larches, and pines, grow so much faster than oaks, ashes, &c. as not only to deprive them of a very considerable proportion of that nourishment, which would otherwise have fallen to their share, but also, by shading and depriving them of the benefit of the light, they are drawn up in such a way as to bear more resemblance to hot-house plants, than trees that are meant to grow and encounter the blasts of a northern climate; accordingly, it is too often seen, that when the firs and evergreens are removed, the tender branches of the oaks, &c. are instantly affected by the nipping blasts, in such a manner, as not only to check their growth for several years, but in many instances to kill them entirely."

In order "to remedy this inconvenience, it is necessary, he thinks, that the belts should be made either entirely of firs, and trees of that description, or of deciduous plants, such as oak, ash, &c. In these ways, the whole plantation will enjoy an equal share of the light, heat, and air; and none of the trees will shade or prove detrimental to the others. It is known, from experience, that plantations formed in this manner, if they are planted thick enough, grow equally fast, and form much stronger and healthier trees, than in cases where firs, and other trees of that description, are planted along with them."

In respect to the manner of making these belts, various modes are, he says, followed: "sometimes they run in straight lines, sometimes serpentine, and at other times circular, or nearly so; all of which have both use and ornament to recommend them. Where it is meant to allow the fields to remain constantly in pasture, the serpentine and circular belts will, he thinks, not only look better, but at the same time afford the most complete shelter: where the lands incline directly south, or nearly so, the belts should run from south to north, as the east and west are generally the prevailing winds in most parts of Britain: upon a north exposure, the belts should also run from south to north, but should be intersected cross-strips or belts at proper distances. By this management, the fields will, he conceives, be secured against every inclemency of the weather; for while the belts, which run in a direction from south to north, screen them from the east and west winds, the cross-belts effectually secure them against the inclemency of the north and north-west gales, which in many places, especially in North Britain, are severely felt" at different seasons. And "the same precaution is necessary, in his opinion, where the lands lean either to the east or west: in both of these cases, cross-belts will be found useful, as they effectually secure the fields against every wind that can blow. The reason for omitting the cross-belts in southern exposures, is very obvious; the high grounds to the north secures them from north and north-west winds, the belts protect them against the gales that come from the west and east; the only wind, therefore, to which they are exposed, is the south; and from the warmth and mildness of south winds, little danger is to be apprehended."

In regard to the manner of protecting these belts, it is different in different situations: "where wood is plenty, he says, a simple paling, or ditch and paling, forms the fence; where stones are plenty, a wall is frequently made use of; but, in by far the

greatest number of cases, a ditch and hedge is employed. (See *Fence.*) Any of these, when properly executed, will answer this purpose extremely well; but as there are some of them better and more durable than others, and as permanence ought never to be lost sight of, either in this, or any other mode of inclosing, it is of consequence to fix upon that, which unites immediate use with durability. The stone wall, sunk fence, and ditch and hedge, are certainly the most durable; the two first are, indeed, complete at once, and every benefit that can be derived from their use, is immediately obtained; the hedge and ditch, on the other hand, rises by very slow degrees, during which the belts are exposed both to the weather, and the injuries arising from sheep, and cattle breaking into, and trampling upon the young trees; after all, it is very seldom that a hedge which surrounds a belt of planting, forms a good or useful fence." See *Hedge.*

It is added, that "where the mode of inclosing with belts of planting has been adopted, and judiciously carried into effect, the advantages have in many instances been very great, especially in high exposed situations. Upon the estate of Leston, in East Lothian, a striking instance of this is, he says, met with: a part of that estate is situated on the declivity of a range of hills, known by the name of Lammarmuir, leaning to the north. About twenty years ago, a part of the lands were enclosed with belts, consisting chiefly of firs, with a mixture of larches; the situation was then so bleak and exposed, and the soil seemingly so bad, that the neighbouring proprietors laughed at the attempt, predicted that it would be abortive, and considered the owner a fool, for laying out his money upon so unpromising a subject. A few years, however, gave them a better opinion, both of his intellects and his undertaking: the trees throve from the first, and, in a short time, the benefit arising from their shelter was sensibly felt. The bleak uncomfortable appearance which the fields formerly exhibited, began to be changed, and a better and more valuable herbage sprung up. This alteration has been progressive, the pasture is now good, and the fields so completely inclosed, as to bid defiance to every wind that blows." And, "in consequence of this change, the soil, which in its original state produced nothing but heath, fern, and some of the very coarsest grasses, and was not worth a shilling an acre, is now rented at twenty, and not considered a dear bargain; yields very good pasture; and notwithstanding its elevation above the level of the sea, and a north exposure, a part of it has lately been ploughed, and produced very good crops of grain. The sheep and young cattle that are reared and fed in these fields, owing to the complete shelter they enjoy, and being left undisturbed by herds, or dogs, thrive amazingly; and in winter, when the weather is inclement, the flocks from the neighbouring heights are drove into these inclosures during the night; and in that way are not only better sheltered, but the attendance of servants is rendered unnecessary." And at the same time, "the thinnings of these belts have much more than repaid the expense originally incurred in making them;" which is a circumstance of great importance, and which holds out a proper encouragement to those proprietors who have tracts of land of these kinds.

BENTS, a sort of strawy seed-stems of the blade-grasses, frequent in poor dry pastures. It also sometimes signifies a species of rush (*juncus squarrosus*), which grows on moorland hills.

BENT-*Grass*, a species of grass very common in pasture grounds; there are several sorts of this grass, but that called fine-bent is perhaps the best. See *Agrostis*.

BERBERRY, a term sometimes applied to the barbery. See *Barbery*.

BERE, a term applied to a species of barley. It is sometimes called bear. See *Barley*.

BERNE-MACHINE, the name of an engine, invented by Peter Sommer, a native of Berne in Switzerland, for rooting up trees.

This engine consists of three principal parts, the beam, the ram, and the lever, as shown in *plate* II. *fig.* 7. The beam *a b c*, of which only one side is seen in the figure, is composed of two stout planks of oak of three inches thick at least, and separated by two transverse pieces of the same wood at *a* and *c*, about three inches thick. These planks are bored through with corresponding holes, as represented in the figure, to receive iron pins, upon which the lever acts between the two sides of the beam, and which are shifted higher and higher, as the tree is raised, or rather pushed out of its place. The sides are well secured at top and bottom, by strong iron hoops. The iron pins on which the lever rests should be an inch and a quarter, and the holes through which they pass an inch and a half in diameter. The position of these holes is sufficiently indicated by the figure. The foot of the beam, when the machine is in action, is secured by stakes represented at *g*, driven into the earth.

The ram *d*, which is made of oak, elm, or some other strong wood, is capped with three strong iron spikes, represented at *f*, which takes fast hold of the tree. This ram is six or eight inches square, and a slit is cut lengthwise through the middle of it, from its lower end at *b*, to the first ferule *a*, in order to allow room for the chain *g h* to play round the pulley *k*, which should be four inches thick, and nine inches in diameter. This ram is raised by means of the chain *g h*, which should be about ten feet long, with links four inches and three quarters in length, and an inch thick. One end of this chain is fastened to the top of the beam at *c*, while the other, after passing through the lower part of the ram, and over the pulley *k*, terminates in a ring or link represented at *fig.* 9, the two ears *m*, *n* of which serve to keep it in a true position between the two planks of the beam. In this ring the hook *p* is inserted.

This hook is represented in profile at *fig.* 8. where *f* is the part that takes hold of the ring. But it must be observed, that the parts of this machine, represented at *figs.* 8 and 9, are drawn on a scale twice as large as the whole engine, *fig.* 7.

The hook *f*, *fig.* 8, should be made of very tough iron, as well as the handle *d*, and the arch *c c*. This handle should be two inches thick at *z*, where it joins to the hook, and the thickness gradually lesson by

degrees up to the arch, which need not be more than half an inch thick.

On each side of the pin z is a semi-circular notch, x, y, which rests alternately on the pins, when the machine is worked. The hole d, and the arch e c, serve to fix a long lever of wood $e f$, *fig.* 7, by means of two iron pins; and by this contrivance the lever is either raised or depressed at pleasure, in order to render the working of the machine easy in whatever part of the beam the lever may be placed: for without this contrivance, the extremity of the lever e f would, when the handle d f was near the top of the beam c, be much higher than men standing upon the ground could reach. It must, however, be remembered, that the lever is often shortened by this contrivance, and consequently its power lessened.

The machine is worked in the following method: it is placed against a tree, in the manner represented in the figure, so that the iron spikes at f may have hold of the tree, and the end of the beam a be supported by stakes represented at g. The iron handle, *fig.* 8, is placed in the opening between the two planks of the beam, and the wooden lever fixed to it by means of the iron pins already mentioned. The hook f takes hold of the chain, and one of the iron pins is thrust into the outer row of holes, by which means the outer notch x will rest on the pin, which will now be the centre of motion; and the end of the lever e, *fig.* 7, being pressed downwards, the other notch y, *fig.* 8, will be raised, and at the same time the chain, and consequently the ram. The other iron pin is now to be thrust into the hole in the inner row, next above that which was before the centre of motion, and the end of the lever, e, *fig.* 7, elevated or pushed upwards, the latter pin on which the notch y rests now becoming the centre of motion. By this alternate motion of the lever, and shifting the pins, the chain is drawn upwards, over the pulley k, and consequently the whole force of the engine exerted against the tree. There is a small wheel at l, in order to lessen the friction of that part of the machine.

From this account it may be easily perceived, that the machine is nothing more than a single pulley, compounded with a lever of the first and second order; and therefore its power may be computed from the nature of the pulley and lever. It must, however, be remembered, that as the push of the engine is given in an oblique direction, it must exert a greater or smaller force against the roots of trees in proportion to the angle formed by the machine with the plane of the horizon; and that the angle of 45 deg. is the maximum, or that in which the machine will exert its greatest force against the horizontal roots of the tree.

M. Tscharner, secretary to the Berne Society, observes, that, by repeated experiments with this machine, he has found that the chain g h is so far from giving an additional power, that it hinders the play and effect of the engine by its friction; and that when the ram presses strongly against the beams, the chain is squeezed between the beams so as to render the upper holes useless, and prevents the machine from being worked out to its full length; in consequence of which it is obliged to be removed from its first place, and fixed again anew; which necessarily occasions a loss of time. He also found that the ram was too short, and has therefore taken away the chain, and lengthened the ram four feet.

On account of the inconvenience of the chain, this instrument has therefore been constructed without it. The ram, in this case, moves between the two cheeks of the beam, and is pushed up by the alternate motion of the lever. And in order that the force of the machine might not be lessened by the removal of the chain, the lever is made of twice the common length.

It is evident that an engine, constructed in this manner with sufficient power, may often be highly useful in saving the labour of men; though it may occasionally be inadequate to the task intended, that of tearing up trees by the roots, as, from actual experiments, it has been found that trees above sixteen inches in diameter, especially oaks and elms, can seldom be forced up with this engine, without the assistance of cutting their roots.

BIENNIAL, any thing that continues or endures two years. This term is usually applied to plants.

Biennial *Plants*, such as continue two years.

BIG, a term sometimes applied to a coarse sort of wheat or barley, the same with bere, or square barley. See *Barley*.

BIGGE, a provincial term, sometimes used for a pap or teat.

BILL, an edge-tool frequently employed by husbandmen in cutting hedges and other purposes. It is a kind of hatchet with a hooked point, and a handle shorter or longer, according to the particular uses for which it is intended.

BIN, a small box or other contrivance, in which grain of any kind is kept. It is sometimes written *Binn*.

Bin likewise sometimes signifies a sort of crib for containing straw or other bulky fodder in farm-yards. See *Cow-cribs*.

Corn-Bin, a sort of convenient box or chest fixed in the stable for the purpose of containing grain or other provinder for horses. It should be placed in the most convenient manner, and have sufficient dimensions for containing the necessary supplies of grain for the quantity of horses that are kept.

They are constructed in different methods, according to circumstances, but when placed in the room above the stable, or so as to have the corn drawn out below when it is wanted, they are probably the most convenient, as much time and trouble is saved in the feeding of the horses, as well as the corn kept more secure. And besides, the farmer may easily see that the corn is duely given to the animals.

At *fig.* 1, in the plate on the internal parts of stables, is represented a corn-bin of this kind, in which a is the wall of the stable, b the floor of the room above, c the corn-bin, with the air-spouts, d a spout below the bin, for letting the corn down to the stable; e a slider of plate-iron, at the bottom of the spout, to open or shut at pleasure; but which may be locked by a padlock when necessary; f another thin iron slider, so placed that by shutting it after the spout is filled down to e, there will be contained between c

and *f* exactly a feed of corn, which may be taken away by opening *e*; then *e* being again shut and *f* opened, another feed is let down, which on shutting *f* is also taken away as before, and may be thus repeated as found necessary.

The large chests or boxes that are in general use for this purpose, are extremely awkward and troublesome, where a number of horses are to be fed.

Hop-Bin, a term applied to a sort of box made for the purpose of putting hops into. See *Hops*.

BIND-WEED, a troublesome kind of weed, of which there are two species, the smaller and the larger. The first, or smaller bind-weed, frequently called gravel bind-weed, is very common upon dry banks, and in gravelly ground in most districts, and is generally a sign of gravel lying near the surface. Its roots penetrate very deep into the ground, whence it is in some places vulgarly called *devil's guts*. It is a very troublesome and difficult weed both in the culture of the garden and field.

The second kind or larger bind-weed is also an equally troublesome weed; but in an open clear spot of ground, when the plants are kept constantly hoed down for three or four months, it may sometimes be effectually destroyed; as when the stalks are broken or cut, a milky juice flows out, by which the roots are exhausted, and decay; but as every part of the root will grow, this circumstance renders it a troublesome weed to eradicate, where its roots are intermixed with those of other plants.

After observing that this weed probably propagates itself in pasture-grounds chiefly by its seeds, and in arable land by its roots, as it seems to flower too late in corn to seed before it is cut, Mr. Lisle thinks the reason why it is most apt to multiply in clayey soils is because such grounds are, in the common practice of husbandry, ploughed only in winter months, after wheat, for other crops, as barley, peas, or oats, and not till about September for winter vetches; this tillage cannot therefore destroy the roots or seeds of weeds like the summer fallows for wheat, but, on the contrary, promotes their increase, particularly from the off-sets, or joints of the roots.

BINDERS, a term in farriery. See *Bars*.

BINK, a provincial term, applied to a sort of bench or seat, at the doors of cottages, mostly formed of stones; but sometimes of earth planted on the top with camomile, or some other similar plant.

BIRCH, the name of a well-known tree. This tree is not much esteemed for its wood, but it may be cultivated to advantage upon barren land, where better trees will not thrive; as there is scarcely any ground so bad but that this tree will grow in it. It will grow in moist springy lands, or in dry gravel or sand, where there is little surface mould: so that upon ground which produced nothing but moss, these trees have succeeded so well as to be fit to cut in ten years after planting, when they have been sold for near ten pounds per acre standing, and the after-produce has been considerably increased. As many of the woods in different places, which were chiefly stocked with these trees, have of late years been grubbed up and cleared, the value of these plantations have of course advanced. Persons who are possessed of such poor land cannot therefore employ it better than by planting it with these trees, especially as the expense of doing it is not great. The best method of cultivating this tree, where it can be done, is by procuring young plants from the woods, where they grow naturally; but in places where there are no young plants to be procured in this way, they may be raised from seeds, which should be carefully gathered in the autumn, as soon as the scales under which they are lodged begin to open, otherwise they soon fall out and are lost. As the seeds are small, they should not be buried deep in the ground. The autumn is the best season for sowing, which should be done in a shady situation, as the plants thrive better when they are not exposed to the full sun. The young plants should be taken up with great care, that the roots may not be injured. The ground where they are to be planted requires no particular preparation: all that is necessary is, to loosen the ground well with a spade or mattock, in the places where the plants are to be put, making holes to receive their roots, and covering them again when the plants are placed in them, by carefully closing the earth to their roots. If the plants be young, and have not much top, they require no pruning; but where they have bushy heads, they should be shortened to prevent their being shaken and displaced by the wind. When the plants have taken root, they require no other care but to keep them free from weeds by hoeing, or some other means.

Trees of this kind may be planted any time from the middle of October till the middle of March, when the ground is not frozen; but the autumn is the best season in dry land, and the spring for moist. The distance which they should be planted is four feet square, that they may soon cover the ground, and by standing close draw each other up; for in situations where they are much exposed, if they be not pretty close, they will not thrive well. If the plants take kindly to the ground, they will generally be fit to cut in about ten years; and afterwards they may be cut every seventh or eighth year, if they are designed for the broom-makers only; but where theyare intended for hoops, they should not be cut oftener than every twelfth year. The broom-makers are constant customers for birch in all places in the vicinity of London, or where it is near water-carriage; but in most other parts the hoop-benders are the purchasers; the larger trees are often bought by the turners; and the wood is used for making ox-yokes, and other instruments of husbandry. In some of the northern parts of Europe, the wood of this tree is likewise greatly used for making of carriages and wheels, being hard, and of long duration. In France, it is much used for making wooden shoes. It also makes very good fuel.

In some districts these trees are tapped in the spring, and the sap drawn out, in order to be fermented and made into wine, which has been sometimes recommended for the stone and gravel, as well as the sap, before it has undergone the process of fermentation. The bark of the birch-tree is said to be almost incorruptible. In Sweden the houses are covered with it, where it is found to last many years. It frequently

happens that the wood is entirely rotten, and the bark perfectly sound and good.

The best method of obtaining the sap of the birch-tree, for making of wine and other similar purposes, is by boring a hole, slanting upwards, with a middle-sized auger, to a moderate depth in the tree, and then fastening a bottle to the orifice, by which means a large quantity of sap may be procured. Or many gallons in a day may be collected from the boughs of the trees by cutting them off, so as to leave their ends fit to go into the mouths of bottles, which, by being appended to them, may receive the liquor as it flows from their extremities.

The proper season for this business is from the end of February to the end of March, whilst the sap rises, and before the leaves shoot out from the tree; for when the sap is forward, and the leaves begin to appear, the juice, by a long digestion in the branch, grows thick and coloured, which before was thin and limpid. The sap does not flow much either in the night, or in cold weather, while the north and east winds prevail, but very well and freely when the south-west winds blow or the sun shines warm. The liquor that proceeds from the branches is best, from its having been longer in the tree, and thereby better digested, and acquired more of its flavour than if it had been extracted from the trunk. In order to have enough of liquor to begin the making of wine, many trees should be tapped at the same time, so that a sufficient quantity of sap may be obtained in a few days; for it will not keep long without a tendency to putrefaction. To prevent this, some advise setting that which is first drawn in bottles, or other proper vessels, in the sun, till the rest be ready, and to put into it a hard toast of rye-bread cut thin, to make it ferment. But as it is necessary to mix either sugar or raisins with the juice, in order to give it a body and enable it to undergo a regular fermentation, by which alone it is rendered fit for keeping, such a fermentation must necessarily be hurtful. When therefore a sufficient number of trees cannot be tapped to obtain enough for the purpose of making wine in two or three days, the most advisable way may be to put it into very sweet vessels, and place them in a cool cellar, as it will keep there perfectly sound for a long time, especially if it be covered with oil, or bunged up close, to exclude the action of the external air upon it.

In the preparation of the wine, the proportion of sugar may be varied according to the taste and intention of the maker: but, in general, a pound of sugar is the proper allowance for a gallon of liquor. The sap and sugar must be thoroughly united by a heat just sufficient to make them boil; but the long boiling, which is generally advised, can answer no good purpose: on the contrary, it must render the liquor less disposed to ferment kindly, and likewise deprive it of a considerable part of the peculiar fragrance and flavour of the tree from whence it was taken. It should therefore be carefully remembered, that the sole purpose of boiling the liquor is, to make a thorough dissolution of the sugar in it. Some people substitute honey instead of sugar; in this case a quart of honey is esteemed equal to a pound of sugar. In regard to spices, they must be left to the taste and opinion of the maker. It is generally found necessary, in order to ferment this liquor, to put into it a little yeast, with a bit of dough, or thin toast of bread, after which it is treated in all respects like other vinous liquors. See *Fermentation* and *Wine*.

When the juice of the birch, or plane-tree can be readily procured in large quantities, it may be used for brewing instead of water, as it is found to make equally strong beer with much less malt. It is asserted by Dr. Tong, in the Philosophical Transactions, that one bushel of malt brewed with this liquor will make as good ale as four bushels with common water. He thinks the sap of the sycamore the best for this purpose, because it is very sweet and wholesome. An oil is prepared from the white bark of this tree, either taken from it while living or after it is cut down. It is said that the fine smell of the celebrated Russian leather depends upon this oil.

BIRD, a term applied to any sort of winged fowl. See *Fowl*.

Birds-*Eye*, a troublesome weed in fields, sometimes termed germander speedwell (*veronica chamædrys*).

Birds-Foot *Trefoil*, the common name of a plant that flourishes in a singular manner in the most exposed and dry situations. On bowling-greens and mown lawns it forms a fine green close herbage, even in hot seasons; and in meadow and pasture grounds it is frequently abundant. Its very strong deep tap-root is the cause of its resisting drought so greatly. Some of the varieties of this plant might probably be cultivated with profit in dry situations.

Bird-*Grass*, a kind of grass brought from Virginia in America. The Rev. Dr. Elliott, of New England, says, that this odd name was given it from being brought into a piece of poor meadow at Dedham by ducks and other wild water-fowl.

Mr. Roque is said to have successfully cultivated this species of grass; and his account is, that in the month of March, 1764, he received from the late Peter Wych, Esq. an ounce and a half of the seed of a species of grass called bird-grass. It had been obtained from Virginia, where it grows, though it is not a native grass. Not being acquainted with the particular nature of this grass, he prepared the ground for it in the same manner he should have done for a flower-bed, raking it with a wooden rake: he did this, as he was willing by every means to secure its coming up; but this was not in the least necessary, as appeared from its great hardiness and force of vegetating power.

The size of the piece of ground on which it was sown was about twenty rods; part of it a little gravelly, and the other part of it moory land. He soon perceived that it grew better on the gravelly than on the moory part of the ground, that on the gravelly being of a better colour and sweeter than that on the moory, which was pale and yellow. And with respect to the moory ground itself, one part was moister than the other, and the grass grew better on the drier side than on that which was wet. It, however, looked well all the summer; and in the month of September

following he began to gather the seed, and proceeded in it till October. The quantity of seed was above twelve pounds.

It is remarked, that the first year the grass did not grow to above two feet and a half high; but that in the second it rose to be four feet high. On the 14th of June of that year, being 1765, he measured out ten rods of this grass, and cut it. Three days after he weighed the product of these ten rods, herb and seed together, and they amounted to twelve hundred pounds. The 10th of August following, the same grass was again grown to the height of two feet eight inches, and was a second time fit to cut for hay; but he did not cut it, as he wanted a second crop of seed, which he obtained in the beginning of October; and it proved a much greater crop than the former. About this time a great deal of rain fell, which occasioned him no small share of trouble in drying the grass, and turning the little cocks. He then first remarked that shoots were made from almost every joint, in consequence of the moisture; but from some more than others, and of these many were of a finger's length. Had he not suffered this grass to stand, that he might have the seed, he is satisfied he could have mowed it thrice in the year; but wanting to collect as great a quantity as he could of the seed, he has not yet actually tried that experiment. He is very confident, however, that this kind of grass may be brought to afford eight tons of hay per acre in the year.

He observes farther, that this grass has a peculiar quality different from what is found in any other kind he ever knew before; which is, that it has very short joints, and that every joint sends out shoots which strike root whenever they touch the ground. On taking a full grown plant of the grass out of the ground, it will be found, moreover, capable of being divided into twenty smaller roots or off-sets, proper to be again planted: and these off-sets, though taken thus from the root, even in the beginning of July, will bear seed the same year. If, likewise, when this grass is ready to be mowed, there should happen to be much rain, no damage will ensue in waiting for fair weather. Because, as this grass is constantly sending out shoots at every joint, it always keeps fresh, and does not wither or rot at the bottom, as most other grasses do; but, on the contrary, it continues green, even till the seed is ripe, which is certainly a very singular property, and of great consequence.

The goodness of this kind of grass may, also, he says, be inferred from the following particular. When he had sown it, which was in the month of April 1764, he had, as has been observed, only one ounce and a half of seed: but betwixt that time and the present he has found such a surprising increase, that he has collected from the successive crops of this ounce and a half, as much seed as has sown two hundred and fifty acres of land; and had besides as much by him as would sow one hundred acres more.

It is likewise asserted, that this grass has every quality requisite to make good hay. That it is easily propagated, and from a very small portion of seed. That it is not subject to rot, or fall in patches, as most other kinds of grass do. That it has a beautiful green at all times, and consequently affords a most pleasing verdure, when sown in sight of any house, or made part of any prospect. And lastly, that the produce of hay from it is extremely great, being much more than any other kind of true grass will yield. Of the truth of all this many persons, he says, have been witness, who have, on seeing the real trials respecting it, given the greatest encomium on it.

The ground on which the seed of this kind of grass is intended to be sown, should, we are told, be prepared in the manner that is proper for lucerne: that is, it should be well ploughed and harrowed, and cleared as much as possible from all weeds, in the same way as is done for barley. When the ground is well mellowed and sweetened, the seed may be sown, the quantity of which may be about one pound and a half per acre: and the time of doing it from March to April. Before the bird-grass seed is sown, it will be proper to sow as much barley or oats as will afford half a crop; and such barley or oats being harrowed in, the pound and half of bird grass-seed should be sown over it; after which, in general cases, the ground is only to be rolled the first opportunity when it is dry. But if the soil be sandy or dry, it may be proper to give it a very light harrowing. This kind of grass cannot be well sown without some corn, because it is of so fine and delicate a nature, at its first coming up, that the weeds would overpower and choak it at that time; or a greater expense would be necessary for clearing them away by hand. But when this grass is so mature as to be in the state of a pasture, or fit to cut, it grows extremely close and thick. As to the nature of the soil proper for the culture of bird-grass, almost every kind will do very well for it; except, as has been observed before, such as is too wet or moory; and this is one of the good properties of this grass, because few kinds flourish much on dry gravelly ground. See *Grass*.

Bird's-*Nest*, a name applied in some districts to a weed sometimes met with in the poor gravelly or thinner kinds of soils. See *Carrot*.

BIRDLIME, a resinous material, chiefly obtained from the bark of the holly tree, by means of boiling, and afterwards laying it in a moist damp place, then pounding and washing away the coarse parts of it. This substance possesses great adhesiveness to feathers and other dry porous matters, hence probably its name. Dr. Darwin observes, it resembles the caoutchouc or elastic resin, and also a fossil elastic bitumen found near Matlock in Derbyshire, both in its elasticity and inflammability. Where the holly abounds, that substance may probably be made an article of profit.

BISHOPING, a cant term made use of among horse-jockeys, implying the unfair practices employed to conceal the age of an old horse, or the ill properties of a bad one.

These, according to Mr. Richard Lawrence, are tried upon the other parts of the mouth as well as the teeth, though these are chiefly practised upon, in order "to furnish the corner teeth with the same marks which they possess at seven years old."

They form, says he, an artificial cavity in the head of the tooth with an engraving tool, and give it a black colour by burning it with a hot iron. By such practices as these, an inexperienced person may be deceived; but by attending to the following observations, the imposition may be easily detected; for although the dealer has it in his power to make marks or cavities in the corner teeth, yet he cannot alter their horizontal direction, nor restore them to the perpendicular approximation which is the attendant of youth. Neither can he re-produce the prominence of the ridges of the roof of the mouth, nor furnish the tushes with their original concave surfaces. As it suits the purpose of the dealer to make an old horse appear younger, so does he sometimes find it convenient to make a young horse appear older. A horse is more saleable at five years old than at four, on which account the dealer attempts to produce an additional year, by drawing the corner teeth before the natural period of their dropping out. The bars of the mouth are also cut to let the tushes protrude prematurely. But although the corner teeth are removed, and the protrusion of the new teeth is thereby somewhat accelerated, yet it is an unerring rule, that the animal has not attained his fifth year until the corner teeth, both of the upper and lower jaw, are complete in their size and appearance, and the marks of the middle teeth begin to fill up. The tushes also should rise considerably above the jaw." See *Age of Horses*.

BISSLINGS, a provincial word applied to the first milk of the new-calved cow.

BISSLING *Milk*, the same as bisslings.

BIT, the iron part of a bridle, or that which is put into the horse's mouth. Bits are of different sorts; as, 1. The musrol, snaffle, or watering bit. 2. The cannon-mouth, jointed in the middle. 3. The cannon with a fast mouth, all of a piece, only knee'd in the middle, to form a liberty or space for the tongue; fit for horses too sensible, or ticklish, and liable to be continually bearing on the hand. 4. The cannon-mouth, with the liberty in form of a pigeon's neck; proper where a horse has too large a tongue. 5. The cannon with a port mouth, and an upset or mounting liberty; where a horse has a good mouth, but large tongue. 6. The scatch-mouth, with an upset; ruder but more secure than a cannon-mouth. 7. The cannon-mouth with a liberty; proper for a horse with a large tongue, and round bars. 8. The mastica-dour, or slavering bit, &c. The several parts of a snaffle, or curb-bit, are the mouth-piece, the cheeks and eyes, guard of the check, head of the cheeks, the port, the welts, the campanel or curb and hook, the bosses, the bolsters and rabbets, the water-chains, the side-bolts, and rings, kirkles of the bit or curb trench, top-rol, flap and jieve. It is sometimes written *Bitt*.

The horse should have the bit suited to the state of his mouth.

BITE, in *farriery*, a kind of wound mostly inflicted by one animal biting another. The separation of the fleshy parts thus produced, is, in general, to be considered and managed as a lacerated wound; since the teeth, though more or less capable of incision, are not adapted to produce such a wound as is capable of being united by what is termed the first intention. The proper treatment consists in approximating the sides of the wound, and confining them moderately with adhesive plaster, or by a bandage, or both together, but not by any means by ligature until the sore begins to discharge; after which it should be dressed daily with any simple ointment spread on tow.

Where the bite is of the venomous kind, as from the viper, or a mad animal, the wound must be well washed to remove the poison, and then treated as above. Though, in the latter case, the only safe mode is immediately to extirpate all the parts that may have come in contact with the poison.

Mr. John Lawrence remarks, that in punctures from the stings of hornets or wasps, or wounds by the tusks of a boar, which last are apt to swell as if venom had been really instilled, they should be washed clean with warm soap-suds, and anointed well several times a-day with warm salad-oil. Emollient poultices, and fomentations, prepared with rue, worm-wood, bay-leaves, rag-weed, and wood-ashes, should likewise be used. And they may be healed with Ægyptiacum and brandy mixed; and saline physic, or nitrated water, if feverish symptoms supervene, should be given.

He adds, that "the bite of a viper is of far worse consequence; not only the wounded part, but sometimes the whole body will be considerably swelled." And advises us to make a tight bandage above the wound, if upon a limb, to enlarge the wound with a small sharp pointed cautery, avoiding the tendons, and keep it open as long as the venomous symptoms remain, with a sponge smeared with precipitate ointment, or orrice root prepared with Spanish flies. To "rub in warm oil mixed with viper's fat, both to the wound and the swelled parts." To wash with the following lotion:

Take of strong vinegar, one pint; mustard-seed, two ounces; mix, stop them close a few hours, and strain.

To dress with warm Ægyptiacum, once or twice a-day. In some cases bleeding, he says, is required. And the following drink may be given every night for a week:

Take of venice treacle, one ounce; salt of hartshorn, one drachm; cinnabar of antimony, half an ounce; sweet oil, three ounces: This may be given in warm ale.

In respect to the poison of rabid animals, it is observed, that "no new discoveries have been made, excepting that the *hydrophobia*, or dread of water, is not a peculiar consequence, or symptom of the rabid poison, although its general attendant: but merely sympathetic affection from a pained tendon, analogous to the *tetanus*, or locked-jaw. Hydrophobia has been known to attend hysteric cases, and painful wounds in the tendons, and to precede the locked-jaw in the human subject."

And it is added, that "in the bite of a mad dog (for in that animal the contagious rabid poison seems to originate, or of any animal which being bitten acquires the power of propagating the poison), the only remedies entitled to any rational dependence, are, as has been suggested above, instant exsection, or cutting away the bitten part, ustion or burning, and mer-

curials. The Ormskirk Medicine, Dr. Mean's remedy, bathing in salt-water, and many other pretended specifics, have all failed; and, as he should conceive, never had any real title to do otherwise. Besides burning the wound, where practicable, a circle ought to be drawn round it with a cautery." And "rub the part with strong mercurial ointment and turpentine as often as possible, without raising a salivation. Turbith mineral (*vitriolated quicksilver)* has succeeded in the cure of dogs, of course it ought to be tried with horses, and also with human patients. Bartlet advises turbith mineral and camphor in equal quantities. Before or after the turbith course, the horse should be frequently plunged in cold water."

The signs which indicate the presence of this disease, "are hunger and thirst, without power to eat or drink, trembling, eyes fierce and flaming, hanging of the ears and tail which is bent inwards, lolling of the tongue, foaming, barking of the dog at his own shadow, panting, running a straight and heedless course against any thing in his way, biting with violence; other dogs fly him by instinct." See *Canine Madness.*

It is supposed by Mr. Taplin, that the jaundice and affection of the liver in horses, is sometimes occasioned by the bites of venomous insects or other animals. "Whether such inflammation or bilious appearance," says he, "is produced by the bite or not, if there are other local symptoms, as swelling, pain, and inflammation, bleeding becomes immediately proper; then let the part be well washed with soap and warm water, so as to raise a substantial lather; wipe dry with a cloth, and bathe the surrounding parts for some minutes with equal portions of fine olive oil and white-wine vinegar: afterwards apply a poultice of emollient ingredients, and let it be repeated twice a-day till the swelling or symptoms subside. Should the horse be attacked with a violent symptomatic fever to a great degree, adopt the methods recommended in such cases; at any rate give one ounce of nitre twice a-day in his water, and assist in cooling the body by mashes to relax, prepared with malt and bran equal parts, or oats, bran, and a few ounces of honey."

Venomous effects are often ascribed to the bites of animals, that have no means of infusing such poison, as the *slow-worm*, &c.

Biter, a provincial term applied to the black cap.

BLACK, a common colour in horses. Horses of this colour are most esteemed when they are of a jet shining black, and well marked, without having too much white round their eyes and up their legs. The English black horses have generally more white about them than the black horses of other countries. The Spanish, Arabian, Dutch, and Danish horses of this colour have seldom much white, though a star or blaze, and sometimes a white muzzle, or one or more of the feet tipped with white is common. Some black horses have brown muzzles, and are brownish on their flanks, as well as between their hips. These are often called black browns, as they are not a perfect black, but approach near to the colour of a tawny black; some are of a lighter colour about their muzzles, and are called mealy-mouthed horses; and of this sort are the pigeon-eyed horses, which have a white circle round their eye-lids, and their fundaments often white. Those that partake most of the brown are said to be the strongest in constitution. See *Horse.*

Black-*Canker*, a disease in turnip and other crops, produced by a species of caterpillar.

It is observed by Mr. Young, in the second volume of the Annals of Agriculture, that these insects were effectually destroyed by Mr. Coke at Holkham in Norfolk, by turning a number of ducks among the turnips when injured by these insects. On the 16th of July, says he, they were turned into thirty-three acres, having water at one corner of the field, and in five days they cleared the whole completely, marching at last through the field on the hunt, eyeing the leaves on both sides with great care to devour every one they could see, and filling their crops several times in the day. The ducks, after having saved about sixty pounds worth of turnips, were sent to the poultry-yards.

Black-*Cattle*, a term sometimes applied to a small hardy breed of cattle, mostly of a black colour, occupying the high or mountainous districts in the more northern parts of the island. They are covered with a long close coat of hair of much the same kind as the polled and long-horned breeds. They feed readily in the rich pastures in the southern parts of the kingdom, where large quantities of them are annually driven and fed for sale in the London and other markets. Their beef is generally of a fine grain, well marbled, and of a good flavour, but sometimes not so fine and bright in its external appearance as that of other sorts of cattle, being frequently, except when made very fat, spotted with black even upon the choicest parts. From their property of becoming quickly fat, and not being of great weight, they seem well adapted to the low rich grazing districts in the southern counties of England, where the lands are liable to be poached and injured by the heavier breeds of cattle. They seldom weigh more than from twenty to thirty stones each, though some particular ones have become considerably heavier. It is also frequently applied to neat-cattle in general.

Black-*Dolphin*, a term applied to a small insect which is frequently very destructive to bean, turnip, and some other crops. Where beans are attacked with these insects, the best remedy probably is, as soon as they are perceived, to cut off the tops by means of a scythe, as they are found to make their first lodgments principally in those parts of the plants.

Black-*Fly*, a term applied to an insect of the beetle tribe, that often commits great devastation among turnip and other crops, destroying the young plants by feeding upon their seed-leaves the moment they are protruded and appear above ground. Different remedies have been proposed for the prevention of the destructive ravages of this insect on turnips, but few of them have been attended with much success. The best method is probably that of sowing the seed at such a season, and under such circumstances, as that its early vegetation may be quick and

uninterrupted, and thereby allow little time for the insect to feed upon the plants before they become in broad leaf, and capable of resisting its injurious attacks. See *Fly*.

Black-*Grass*, a name applied to a species of grass cultivated in some parts of America.

It was remarked by Dr. Elliot, that it throve best and grew largest in those meadows which bordered on the tide-rivers, and have the greatest mixture of fresh water. Where the water is very salt it is not apt to fix and spread, but will remain short and poor. It is very tender, and cuts as readily as garden-chives, grows thicker and taller than the common salt-marsh grass, and affords from two to three tons of hay to the acre: but it is a slow grower after it has been cut. Its seeds are small, like those of tobacco. The colour of the grass is a very deep green, which renders it so conspicuously different from every other kind, that it is universally known by the name of black-grass.

This species, he says, introduced itself some time since into the settlement of New England. Our first planters, says he, knew nothing of it; nor has it yet travelled very far south-west. Its first appearance in this colony was on a marsh at Saybrook, to which an old boat was brought down Connecticut river by a great flood, and there cast up. This inclined him to think, that it was originally an inland grass which happened to suit with such salt-marshes as are well supplied with fresh water; and what confirmed him in this opinion was, that a person in the town of Killingworth, where he resides, having cleared a swamp far distant from salt-water, and afterwards sent into this fresh meadow cattle which had been foddered with hay of the black-grass, had there in a short time a fine growth of this grass, which has since not only established itself, spread, extended, and, like a conqueror, beaten out the natural grass, but looks as flourishing in that fresh meadow as any growing on a salt-marsh.

It is remarked by another writer, that the early spring and growth of this grass, its lively green, its great produce, the preference given to it by cattle, when distributed promiscuously with salt-grass for their food; its rendering the turf of mirey, loose, dirty meadows firm and solid, and its extraordinary quality when improved for pasture in the spring and summer, raised its reputation, and endeavours were made to propagate it: but that it proved very sullen and uncertain in its growth, growing only where it chose, from the seed promiscuously shed, and wafted about by the tide which overflowed the meadows.

It was found to grow and flourish well near the banks of rivers which admitted the salt water, and even in flat or low meadows which are in some measure overflowed every tide by the salt-water: but these low meadows must also be of that kind only where there is a course of fresh water when the tide is out; so that a mixture of both fresh and salt-water seems to be necessary for its prolific vegetation.

But it grows largest and best in reedy and rushy coves, or arms of the salt meadows, which are a little higher than the general level of the salt-marsh, which are not commonly overflowed by the flux and reflux of the tides, which lie at some distance from salt creeks or courses of salt water, and which are watered by fresh springs rising from the banks or adjoining uplands.

The writer has seen several such meadows, which flourish remarkably with this sort of grass, though but lately brought under culture: he has been credibly informed, that eight acres of such a cove produced this year thirty-two tons of black-grass, in an adjoining township. This grass, he says, is not near so much impregnated with salt as the common grass, when both of them grow together; and the dew which adheres to the black-grass is fresh, when that on the salt grass is highly impregnated with salt. It is found to thrive best on a clay or strong loam. The natural turf should be broken, and the seed, after being mixed with fresh cow-dung, should be spread and fastened in by treading, that it may not be carried off by the water; or it may be propagated by transplanting the turf taken from a black-grass meadow, by which means it will be made to spread apace. It will also grow where salt-water never reaches. The writer has seen it growing on moist uplands, and the turf has been so firm that it was hard work for six oxen to plough through it.

Black-*Earth*, that kind of earth or mould which contains a large portion of carbonaceous or vegetable matter in its composition. All lands where much vegetable matter has been suffered to decay upon them, possess much earth of this kind, and have a darkish brown or black appearance. Soils of this sort are capable of producing most sorts of grain and other vegetable crops in great abundance.

Black-*Land*, a name given to a sort of soil which has a greyish black cast. This sort of soil, though pale when dry, always blackens by means of rain; and when ploughed up at those seasons, it sticks to the plough-share, and the more it is wrought the muddier and duskier coloured it appears. These sorts of lands, when somewhat fat, yet porous, light, and sufficiently tenacious, are good both for corn and grass; but as they are mostly in bottoms, so the wetness of them often spoils them for corn; but where they are dry they are extraordinarily fruitful, especially for barley; they will bear also good wheat upon an ersh crop: where they are very rich, they may, if a deep mould, be planted with liquorice, or sown with hemp, woad, cole, rape-seed, madder, or some other luxuriant sort of crop that best agrees with such land; and afterwards with corn, when some of the fertility is destroyed. They will also bear excellent clover. The best manure for them is chalk or lime, where they can be had.

Black-*Legs*, a provincial name given in some places to a disease frequent among calves and sheep. In Staffordshire it is called the wood-evil. It is a bloody gelatinous humour, settling in their legs, whence its name; and often in the neck between the skin and the flesh, which makes them carry their necks awry. If it fall on the joints, they frequently overcome it; but if on their bowels, they mostly die.

Black-nebbed *Crow*, a provincial term applied to the carrion crow.

Black-*Oats*, a species of oats much cultivated in the northern parts of England, and esteemed a very good and hearty food for horses. See *Oats*.

Black-*Spald*, in *farriery*, is a disease that frequently attacks young cattle, and sometimes those that are aged. It is shown by lameness in one of the feet, loathing of food, attended with a crackling noise in the affected leg, on the skin being drawn up between the finger and thumb. It is very rapid in its progress, mostly destroying the animals when not removed in from twenty-four or thirty-six hours. It is supposed, by some, to be the same with the *quarter ill* or *evil*. The cure has been attempted by bleeding, bathing the parts with cold water, and after making incisions, or scarifying the skin, rubbing in salt and water, loosening it from the flesh well, and keeping the animal constantly in motion.

On examining the diseased part, much blood has been found collected in it. It is said to be cured with greater difficulty in the fore than the hind quarters, and that when it seizes the bowels, there is probably no remedy for it. But neither the nature of the disorder, or the means of removing it, seem yet well understood.

Black-*Thorn*, a species of thorn well known, and frequently used in making fences, especially in exposed situations. It is not reckoned so good for fences as the white-thorn, because it is apt to run more into the ground, and is not so certain of growing: but when cut, the bushes are much the best, and most lasting of any for dead hedges, or to mend gaps: cattle are not so apt to crop fences of this kind as those of the white-thorn.

Black-*Twitch*, a noxious weed which flourishes even in extremely dry seasons, and is very injurious to many crops.

Black-*Water*, a disease in neat cattle and other sorts of live-stock. The nature and causes of this disorder do not seem yet to have been fully investigated. According to Mr. Downing, the cause may be any thing that constringes the external habit. A great scarcity of water, or bad waters, such as found in ponds, &c. may give rise to the disease; or a sudden change of weather, from hot to cold, will almost certainly bring it on. It is also stated that high pastures are subject to give this disorder, and that some sorts of land more than others, especially to such cattle as are brought from different climates. It is likewise imagined that it may be caused by some plant eaten by the cattle. It is most prevalent upon cold wet land. In the cure he advises the following:

Take dragon's blood, in powder, two ounces; nitre in powder, three ounces; roch alum, in powder, two ounces; bole armenic, one ounce; rhubarb, in powder, half an ounce; red sanders, one ounce: mix them together for two doses, one to be given immediately, in a quart of butter-milk, and repeated every twelve hours.

The beast should fast; and afterwards great care should be taken, he says, not to bleed in this complaint.

He further observes, that sometimes a violent straining comes on; but which seldom happens till the beast has been affected two or three days; in which case the following clyster may be found useful:

Take three quarts of thin gruel; sweet oil, six ounces; common salt, one pound: mix them and inject them up the rectum milk-warm.

The following is an opening drink which should, he says, be given after the water gets better:

Take of Epsom salts, three ounces; nitre in powder, cream of tartar, liquorice powder, each two ounces: mix them for two doses, one to be given in a quart of warm whey or thin gruel, immediately, and repeated as occasion may require.

The following powder has been found useful when other medicines have failed, and to give a turn to the disorder in general, in about twenty-four hours.

Take of dragon's blood one ounce; bole armenic, one ounce: mix them together, to be given in a pint of the best French brandy.

And in two hours after administering the above, one ounce of sweet spirits of nitre should, he says, be given in a quart of skimmed milk or thin gruel.

It is advised that the beast should be kept out of the house, unless when the weather is very wet, cold, or hot, when an open shed will be found the most suitable.

BLADDER, the viscus or bag destined for the reception of the urine in animals.

It is observed by Mr. Ryding, that the bladder in the horse, is subject to spasm on its neck, and to inflammation; producing different symptoms; and that a third may be added, namely, the stone.

The diseases of this part must constantly be attended to immediately, as they will not admit of delay. The first or "inflammation of the bladder may arise from a defective action of the mucous glands situated between its coats, preventing the mucus from being secreted in sufficient quantity, to afford protection against the irritation of the secreted urine. Or it may arise from calcareous concretions passing from the kidneys, by the ureters, into the bladder, causing violent irritation in their passage."

And "the symptoms of inflammation from these two causes are much the same, viz. universal coldness of the extremities, frequently attended with cold sweats; pulse quick; the hind legs are extended wide, with a constant attempt to stale, and the urine continually discharged, but in small quantities. This is owing to the kidneys continuing to secrete the urine; and the smallest quantity, acting as extraneous matter, excites the bladder to contract and an endeavour to expel its contents. When this is the case, our intention of cure must, he says, be directed to the removing of the inflammation, and giving such medicines as may bring the vessels to their proper action.

The first may be effected by frequent bleeding in full quantities, according to the animal's strength. His drink should be mucilaginous fluids; such as the following:

> Take of linseed bruised, half a pound; boiling water, two gallons: Let them stand until nearly cold, and strain the liquor through a coarse cloth:—Then add, of gum-arabic, four ounces, previously dissolved in a quart of boiling water: stir the whole well together for use.

A quart of this mixture may be given every four hours, or may be used as his common drink; and large clysters of warm water may be thrown up the rectum with great advantage.

It is also added, that opium has occasionally been found serviceable in this disease; and, when necessary, may be used in the following manner:

> Take of opium in powder, one drachm; linseed powder, half an ounce; mucilage of gum-arabic sufficient to form a ball:

This may be given every other day; but, where the disease proceeds from calculi, there is but little hopes of effecting a cure.

After the symptoms are removed, the above writer advises a course of the following balls:

> Take of cinchona, in fine powder, twelve ounces; grains of paradise, two ounces; gentian in powder, three ounces; honey, sufficient to form sixteen balls: one of which should be given every morning.

In the second, or spasm of the neck of the bladder, the symptoms are similar to those that attend inflammation of the kidneys; the suppression of urine being only a consequence. This disease most frequently proceeds from a too long retention of urine, especially on a long journey, or too long continued exercise; the horse not being permitted to stale, his bladder becomes so much distended by the accumulating urine, as to lose its contractile powers. It is easily to be distinguished from inflammation of the kidneys; by introducing the hand up the rectum, so as to examine the state of the bladder, which will be found much distended, and, if not speedily relieved, may become paralytic, and incapable of its usual powers.

In this affection, it is necessary to abstain from the use of diuretics, and all fluids, as much as possible. Bleeding may be used freely: large and often repeated clysters of warm water will be found very useful: opium, to the amount of two drachms, may be given with advantage. But when the above methods fail, and the disease continues to increase, the only resource is to puncture the bladder, by the rectum, with a small lancet, which will give immediate relief. But a more advisable mode is that practised at the Veterinary College, which is by an operation calculated to effect the introduction of the catheter. A staff is introduced as far into the urethra as the direction of that canal will admit, then cut down upon, and the catheter introduced through the incision.

And with the above treatment, fomentations are also to be had recourse to, and the loins powerfully stimulated, blistered, or even cauterised. Purging is also proper; and may be effected with a ball, consisting of half an ounce of succotrine aloes, joined with half a drachm or a drachm of calomel. But no exercise should be taken in this case.

With regard to the last, or stone, tho' its existence has been disputed by experienced farriers, there can be no doubt but that it may sometimes be the case; in which situation we have probably no remedy that will be of much utility.

BLADE, the name of a spire of grass or green shoot of corn.

Blade-*Bone*, in *farriery*, a popular name for the shoulder-blade of an animal. It runs from below the withers to the point of the shoulder-bone, which last turns backwards towards the elbow, making an acute angle with the former. And it is joined to the ribs by muscles which have very strong tendons. In the lower end there is a shallow cavity, which receives the head of the shoulder-bone. It is surrounded with a tough cartilaginous substance, and is covered with a broad strong ligament, which not only prevents the shoulder-bone from slipping out, but renders the motion of the shoulder easy, and fit to play in all the necessary directions. In order to have a proper good form, these bones should be connected with the other parts in an easy and regular manner; in which case a horse or other animal is said to have a good shoulder.

Blade-*Grasses*, such as are disposed to rise with blades instead of stems; or which do not run up so quickly to seed-stems.

BLAIN, in *farriery*, a disease in cattle, which frequently affects them in the spring of the year, or beginning of summer, when the weather is gleamy. It has been supposed by some to be occasioned by a little red worm which the cattle lick up when feeding, and which occasioned a bladder or encysted tumor, rising at the root or under the tongue, and, by pressing on the wind-pipe, inducing suffocation.

Others, however, with more propriety, impute the disease to inflammatory causes. It may be known by a watery appearance in the eyes, and, as the distemper advances, by their swelling and becoming inflamed. Mr. Downing, however, describes it more accurately by observing, that the beast "is seized very suddenly with a swelling at the nose, pants and breaths very quick; the eyes are swelled and inflamed, with water gushing therefrom continually, large blisters arising at the root of the tongue: and if not relieved immediately, will swell very much, and the blisters will appear very large at the fundament; also the shape and fundament will appear swelled, and of a liver colour. When proceeding from these last causes, some advise the following drench:

> Take of liquorice, aniseed, turmeric, long-pepper and diapente, each two ounces; boil them slightly in a quart of strong beer.

According to the report of some experienced graziers, bleeding, by running a knife through the ear of the beast near the root, has proved useful, when done in the early stage of the disease.

But, in the first place, Mr. Downing recommends the breaking the blisters in the mouth and throat with the hand, then bleeding plentifully, and giving the beast a pint of the blood with a handful of salt in it. It should likewise be raked backwards, in order

to break the blisters, and bring the dung out of the straight gut; then give the following medicine:

Take of Epsom salt four ounces; aniseed powder, gentian powder, each two ounces; powdered jalap, half an ounce: mix them for one dose, to be given in a quart of ale milk-warm.

The beast should walk about half an hour after the draught is given, and have warm water for two or three days and bran-mashes, to work off the medicine.

He advises by no means to omit bleeding at the beginning of the disease, as in this case it is peculiarly requisite.

BLAKE, a provincial term sometimes applied to the colour which has a yellow similar to bees-wax.

BLASH, a provincial term signifying to splash or sputter.

Blashy, a provincial word, implying wet splashy weather.

BLAST, a vegetable disease, the same as blight. In *farriery*, it is also a vulgar name for any circumscribed swelling or inflammation in the body of an animal. See *Blight*.

Blasting *of Stones*, the operation of tearing asunder large stones or rocks, which are in the way of the plough or other instruments employed in breaking up ground, by means of gun-powder. The method of performing this business is by boring a large hole, eight, ten, twelve, or more inches deep, according to the nature and size of the stone or rock to be blasted, by means of a chisel for the purpose, and then introducing a sufficient quantity of gun-powder, and afterwards carefully ramming the hole up with the small fragments of stone or other solid materials, only leaving a very small aperture, by placing a steel pricker of sufficient length and suitable dimensions, with a handle at the top, at first into the powder, and frequently turning it round while the hole is ramming up. After the hole is quite filled by forcing the hard materials in with a proper instrument, the pricker is withdrawn, and the aperture left by it filled to the top with gun-powder, and then a match of tow, straw, or other light inflammable material laid to it, and set on fire.

It is observed by Mr. Headrick, in the second volume of Communications to the Board of Agriculture, that, in order to perform this operation properly, some experience is necessary, and that a skilful workman can frequently rend stones into three equal pieces without causing their fragments to fly about. This, he says, depends upon the depth and position of the bore. It is also remarked, that a small portion of quick-lime, in fine powder, is said to increase the force, and consequently to diminish the expense of blasting stones. On these grounds the following is offered as a substitute for gun-powder, which is now become very expensive, though, as is freely confessed, without any experience of its effects. Supposing *fig.* 1, *plate* X, to be a large stone to be blasted or rent; *a b*, a bore sent down into it in the usual manner. This bore being then well cleaned out and dried, is to be filled from *b* to *c* with the purest quick-lime, or such as swells most in slaking. That it may be perfectly quick, it should be taken red-hot from the kiln, or from the small furnace where it had been burnt, until it no longer effervesces with an acid; being rammed hard with the jumper or punch, *a c*, the upper part of the bore, is to be crammed with rotten rock in the ordinary way. The pricker being removed leaves the aperture at *b*. *a b*, a small pipe of copper, of less diameter than the needle or pricker, having an orifice about the dimensions of the straw used to convey the fire down to the gun-powder, with a funnel *d* to receive water, is introduced into the aperture. Perhaps a straw or small reed stuck in the lower part of the funnel, among tallow or bees'-wax, might serve the purpose of a copper pipe. Things being thus prepared, pour water into the funnel at *d;* and if the pipe be not too high, so as to prevent the air from escaping from the aperture left by the pricker, it will descend, and cause the lime to slake in the bore *c b*. Every one knows how irresistibly the purest quick-lime attracts water, and with what prodigious force it expands in slaking into three or four times its former bulk. From these data it is therefore inferred, that the slaking of lime, in such circumstances, would burst or rend the stone *s* in pieces; but the success of such an experiment, it is observed, must depend entirely upon using lime of the utmost purity, and having it very hot, and perfectly caustic when it is put in.

It is further remarked, that were the bore *c b* filled with water, and the aperture afterwards rammed up, the water being made to freeze by cold would rend the stone; for, when water passes from a fluid to a solid form, it expands with irresistible force, though frost cannot be much depended upon in this climate.

In order to lessen the expense of gun-powder in this business, Mr. Griffiths has likewise observed in the Transactions of the Bath Society, that in clearing his lands of the heaps of stones with which they abounded, he found the quantity of gunpowder used in the operation to amount to a considerable sum at the end of the year; and as the price of the article has been increasing of late to an enormous amount, he has recourse to an expedient by which the expense of it has been materially diminished.

He weighed out two pounds of gun-powder, and one pound of quick-lime well dried and pulverized, which, after having been thoroughly mixed with each other, he delivered to the blaster with directions to apply it in similar quantities as he would have done the powder by itself. He then selected six of the hardest granites he could find for the experiment, and the effects of the explosion were precisely the same as if powder alone had been used. It now occurred to him that this might be fallacious, and that a smaller proportion of gun-powder would produce the same effect as a larger; he accordingly ordered the man to bore holes in a similar number of stones of the same texture and size with the former, and to put in a lesser quantity of powder by one-third than he would

have done if it had been left to his own management. The stones were, he says, separated by the shock, but the difference in the effect was manifest to every person in the field; those with the mixture of lime and powder having been much more effectually broken and shattered than the others. Since the success of this experiment, he has constantly adhered to the practice, and is so satisfied of its utility, that he wishes to see it more generally adopted. One thing is certain, that a moiety of quick-lime, and gun-powder will explode; and if this mixture were used merely as a train of communication to the powder within the stone, what a national saving would it be in works carried on upon an extensive scale, such as the numerous quarries and mine-works of this kingdom!"

Blasting *of Wood*, the operation of breaking-up or rending logs of wood, such as the roots, &c. of trees, in pieces, by means of gun-powder.

In the Transactions of the Society of Arts, Mr. Knight, from the circumstances of having "frequently observed the great difficulty, labour, and loss of time experienced in breaking-up logs of wood, particularly for the purpose of fuel; such as the stumps and roots of large trees, which remain after the felling of timber, many of which, especially such as consist of the harder and more knotty kinds, as oaks, elms, yews, &c. are frequently left to rot in the ground, in order to avoid the necessary expense of breaking them to pieces in the common way, which is generally effected by the axe, and driving a succession of iron wedges with a sledge-hammer, a laborious and tedious process," has described an apparatus, invented for the purpose of obviating these difficulties and effecting this intention with facility. "Sometimes gun-powder is used, by setting a blast in a similar way to that in mines or stone-quarries. This method, though less laborious than the former, is, he says, tedious, is attended with several difficulties, and requires considerable experience and dexterity, or the plug will be more frequently blown out than the block rent by the explosion. The simplicity of its construction and application is such, he observes, as almost to preclude an idea of its originality; but as it has hitherto appeared entirely new to all his acquaintance, and as he does not know that any thing of the kind has ever before been presented to the public, he is induced to think it may not be unacceptable."

It "consists simply of a screw, with a small hole drilled through its centre. The head of the screw is formed into two strong horns, for the more ready admission of the lever by which it is to be turned, and a wire, for the purpose of occasionally clearing the touch-hole. When a block of wood is to be broken, a hole is to be bored with an auger of a proper depth, and a charge of gun-powder introduced. The screw is to be turned into the hole, till it nearly touches the powder; a quick-match is then to be put down the touch-hole till it reaches the charge. The piece of quick-match is about eighteen inches in length, which affords the operator an opportunity of retiring, after lighting it, to a place of safety." It "is made by steeping a roll of twine or linen thread in a solution of saltpetre."

At *a*, *fig.* 2, *plate* X, is the rending or blowing screw, with a wire *b*, for the purpose of occasionally clearing the touch-hole, previous to the introduction of the quick-match. *c*, *fig.* 3, an auger proper to bore holes, to receive the charge of the screw. *d*, *fig.* 4, a gouge, to make an entrance for the auger. *e*, *fig.* 5, a lever, to wind the screw into the wood, with a leather thong *f* attached to it, in order to fasten it occasionally to the screw, to prevent its being lost, in case it should be thrown out when the block is burst open; a circumstance which does not often occur: for in all his experiments, when the wood has been tolerably sound, he has always found the screw left fixed in one side of the divided mass."

It is further remarked, that "any one who uses the instrument will soon learn what depth of screw will be sufficient to split any root in proportion to its strength, taking care that the screw has sufficient hold to resist the force of the gunpowder, before the root is cleft." The inventor "thinks much powder may be saved by using a cotton match, impregnated by a solution of saltpetre, or any of the combustible matters generally made use of in fire-works; and by the use of the cotton the hole through the screw may be lessened, which will add to the action of the confined powder; though a straw filled with powder, in the manner in which the miners use it, answers very well. Should any one be timid in using the screw, a chain or rope may easily be attached to the screw, and that fixed to any log, or fastened to a stake driven into the ground. If wood is rotten, the screw cannot act." This apparatus may be had of Mr. Knight, Ironmonger, Foster-lane, Cheapside, London.

BLAZE, a white mark or star in the face of a horse.

BLEA, a provincial word applied to a dusky blue or lead colour.

Blea, in the *anatomy* of plants, that part of a tree which lies immediately under the bark, or between that and the hard wood, and which marks the first progress or change of the bark into wood by the natural growth of the tree. While the blea remains in any degree soft, and retains somewhat of the nature of bark, it may maintain a feeble vegetation; but when it is grown absolutely hard and woody, it can no longer contribute to carry on that process. See *Alburnum*.

Blea-*Berry*, a term provincially applied to the common wortle-berry.

BLEB, a provincial term signifying a blister or a bubble.

BLEEDING, an operation frequently necessary in the disorders of different kinds of cattle, particularly horses: and consists in opening a vein by means of an instrument called a fleam.

Such horses as stand much in the stable, and are full fed, require bleeding more than those which are in constant exercise; but especially when their eyes look heavy and dull, or red and inflamed; and

when they look yellow, and the horse is inflamed in his lips and the inside of his mouth; also when he seems hotter than usual, and mangles his hay. These indications not only show that bleeding is required, but likewise the lowering of the diet till more exercise can be enjoined.

Young horses may frequently be bled with advantage when they are shedding their teeth, as it removes those feverish heats to which they are subject at that time.

The spring is the common season for bleeding horses; but periodical bleeding, without its necessity being indicated, should never be practised. In summer, it is often necessary to prevent fevers, always choosing the cool of the morning for the operation, and keeping them cool the remaining part of the day. Some farriers bleed horses three or four times a year, or even oftener, by way of prevention, taking only a very small quantity at a time, as a pint, or a pint and a half, in order to give a brisker motion to the blood, and by that means to preserve or render it more thin and fluid, and prevent its stagnating in the smaller vessels, which is the primary cause of many diseases. There is, however, this inconvenience from frequent bleeding, that it grows into a habit, which, in some cases, cannot be easily broken off without hazard; and, besides, horses are liable to become weak from frequent bleeding.

The cases that require bleeding most are, colds, fevers of the inflammatory kind, falls and bruises, which are mostly dangerous to horses on account of their great weight. Hurts and wounds of the eyes, strains in hard riding, or drawing, and all other accidents where a stagnation of the blood may be suddenly expected, or where the small vessels may be ruptured, and the blood extravasated, also require bleeding; but it should be of the topical kind, or from the blood-vessels of the part which is diseased. Horses that refuse their food after riding, or any sort of work, sometimes require to be bled to prevent fevers and inward inflammations of the lungs, the liver, or any of the principal viscera. Nor is it less necessary to bleed horses at grass, when the purgation is over, and they begin to gather flesh, or at other times when they look heavy about their eyes, for this is an indication for bleeding; and horses feeding in some rank pastures require more bleeding than when in others.

There are also other indications that show the necessity of bleeding by way of prevention, as when some kinds of epidemic distempers prevail among horses; at such times the sound ones may be bled, to keep them from being infected; and where the contagion continues, it may not be amiss to repeat the bleeding once in two or three weeks, or oftener, but in small quantities, for the loss of too much blood may be hurtful in such cases.

But although the cases which may require bleeding are numerous, one general caution is necessary, which is never to take away blood but when it is absolutely necessary; for it is a fluid that may be easily taken away, but cannot be so easily replaced; besides, the practice of bleeding frequently, or at stated times, is exceedingly improper, as it disposes the body to become lax, weak, and plethoric. In bleeding, therefore, a due regard must always be had to the constitution, age, strength, &c. of horses, and the state or habit of body they are in at the time.

In the performing of this operation, attention is particularly necessary to a few circumstances: As horses are naturally fearful, which is frequently increased by improper chastisement, they require, in these cases, to be taken unawares, and the orifice to be made into the vein before they are aware of it. With this intention, the fleam and *blood-stick*, as it is termed, have long been in use, and in skilful hands are proper instruments for the purpose; although with many practitioners the spring-fleam is much safer, and on that account ought to be preferred. When a lancet is used, the instant the horse feels the point of it, he raises or shakes his head and neck, in order to shun it, before the operator has time to make a proper orifice, which frequently proves too small or too large; for this reason, it has been mostly laid aside.

Some veterinary practitioners tie a ligature round the neck, in order to raise the vein, and that they may strike the fleam into it with the greater certainty; but a slight view of its effects in preventing this, and its other consequences, will shew the impropriety of the practice; as when a ligature is tied round the neck previous to bleeding in the jugular veins, it obviously stops the circulation in both veins at the same time; hence they become turgid and very full of blood, insomuch that they feel under the finger like a tight cord; and as the parts around them are loose and soft, when the stroke is given to the fleam, the vein by its hardness or tightness slips to one side, of course it eludes the stroke; hence a deep wound is made by the fleam to no purpose, and this is sometimes too often repeated. Some have likewise a custom of waving or shaking the *blood-stick* before they strike the fleam, which is improper, as it alarms the horse, and prevents the operation from being well performed; as well as sometimes causes mischief by continuing the ligatures till too much blood is accumulated in the head, and disuse induced.

Therefore, ligatures ought never to be used till such time as the opening is made into the vein; and even then it will not be necessary at all times, if the horse can stand on his feet, as a moderate pressure with the finger on the vein will make the blood flow freely; but if the horse is lying on the ground, a ligature may be necessary.

There is also another custom equally absurd, which is that of allowing the blood to fall in a dunghill amongst straw, in dry sand, or in dry dust, by which means no distinct idea can be formed, of the quantity that is or ought to be taken away. In such cases, horses have fallen down and been much injured from the loss of too much blood, before the operator thought of stopping the orifice. For this and other reasons, a measure ought always to be used, in order to ascertain the quantity of blood that is taken away.

Some, in pinning up the orifice, have a custom of raising or drawing out the skin too far from the vein; hence the blood flows from the orifice in the vein into the cellular substance between it and the skin, which causes a large lump or swelling to take place immediately: this frequently ends in what is called a swelled neck; a suppuration follows, which proves both tedious and troublesome to cure. In cases where a horse may be tied up to the rack after bleeding in the neck, pinning up the external orifice may often be dispensed with; but, in other cases, it is necessary that the orifice be pinned up with care, in order to prevent the loss of too much blood.

And as the neck or jugular vein on the near-side is commonly opened for convenience by those who are right-handed, the young practitioner should learn to perform on both sides of the neck, as he will find it in practice to be not only useful but necesssry in various cases.

The place for making the opening in the neck or jugular vein is likewise necessary to be carefully attended to: for when the orifice is made too low, or about the middle of the neck, where the vein lies deep under the muscular teguments, the wound becomes difficult to heal, and frequently ends in a suppuration, with a jetting out of proud flesh from the orifice. The method of cure, in which, by introducing a large piece of corrosive sublimate into the wound, is equally injudicious, as it not only destroys the proud flesh in the lips of the wound, but a considerable portion of the flesh around it. This is called *coreing out the vein.* It often happens, that this application also destroys the vein likewise; and sometimes violent hemorrhages follow, so as to endanger the life of the animal.

It is observed, that the most proper place for making the opening in the jugular vein, is where the teguments are thinnest, which is about a hand-breadth from the head, and about one inch below the branching or joining of the vein which comes from the lower jaw, and which may be distinctly seen when any pressure is made on the main branch of the vein.

In performing the operation with a fleam, the practitioner should hold the fleam between the fore-finger and thumb of the left hand, making a slight pressure on the vein with the second finger, and before it becomes too turgid or full, to open the vein; the same degree of pressure being continued on it, till the quantity of blood necessary is received into a proper measure for the purpose.

It is also a great error, in opening the veins with a fleam, to apply too great a force, or give too violent a stroke on it, as by such means it may be forced through the opposite side of the vein: hence there is danger of wounding the coats of the arteries, as they generally lie under the veins; or, in some particular places, of wounding the tendons, especially when this operation is performed in the legs, and thighs, &c. In the veins, commonly called the plate veins, under the breast, the consequences are frequently very troublesome to remove, and in some cases prove fatal.

When inflammations of the veins succeed bleeding, they require considerable care and attention in the use of emollient fomentations, and subsequent application of blisters and the cautery.

BLEMISH, in *farriery*, any kind of imperfection in a horse, or other animal. Blemishes are of greater or less magnitude, according to the accident which produced them.

In horses they consist of broken knees, loss of hair in the cutting places, mallenders and sallenders, cracked heels, false quarters, splents, or excrescences which do not occasion lameness; and probably windgalls and bog-spavins, where they prevail to any great degree. Mr. John Lawrence observes, that "these last may have been repressed immediately previous to sale, and may re-appear in a few miles riding. Neither wind-galls nor bog-spavins, he says, impede a sound warrant, provided the horse does not go lame; it may be the same, probably, in respect to a false quarter, although, he thinks, he has never seen a horse with the latter defect, which he should have accepted as a sound one, on its being purchased."

In planting, the knots on the outside of trees, and shakes internally, are termed blemishes.

BLENDINGS, a provincial word applied to mixed crops, such as peas and beans when grown together. This sort of mixture should always be avoided, if possible.

BLEND-WATER, in *farriery*, the name of a distemper incident to neat or black-cattle, in which the liver is affected. In order to effect a cure, the old writers on farriery advise the taking of as much bole-armoniac and charcoal-dust as will fill an egg-shell, a good quantity of the inner bark of the oak, dried and powdered; and after pounding the whole together, to give it to the beast in a quart of new milk. Though the disease does not seem to be fully investigated or well understood, the remedy is by no means to be despised.

BLENNORRHŒA, in *farriery*, is a term which implies a flux of mucus of a purulent appearance, from the parts of generation, either in the horse or mare. It is most common in the very young and very old animals, but especially in stallions, whose procreative faculties are called too frequently into action.

Where the disease is produced by debility in a stallion by too much covering, and appears with a thin white discharge, Mr. John Lawrence advises the bathing the testicles with a restringent embrocation at night, and washing them in the morning with cold water, rubbing them dry with a cloth; or the riding him up to the belly in water every morning the first thing. And he directs the following strengthening ball to be given:

Take of balsam of capivi, olibanum, gum-mastic powdered, each two drachms; bole armoniac, half an ounce:

Make them into a ball with honey and liquorice powder, and repeat it at first night and morning, afterwards once a day, as long as it may be necessary. And where there is a foul ichorous discharge from chafing or ulceration, externally or internally, to be-

with washing well with soap and water warm, which it may also be useful to inject. The following may likewise be applied milk-warm, to any excoriation or sore, with a soft rag or sponge:

Take of lime-water, one quart; sugar of lead, half an ounce. Mix.

Where there is fungous flesh rising, half an ounce of vitriolated copper may be added. For an injection, the following is recommended:

Take of balsam of capivi, half an ounce; rubbed with the yolk of an egg; then add lime-water, half a pint; honey of roses, two ounces.

When the yard is much inflamed and swelled, it should be fomented as often as necessary, with the decoction of the leaves of mallows and marsh-mallows, camomile flowers, melilot, and fumitory, each three handfuls; rosemary, wild thyme, southern-wood, and elder-flowers, each two handfuls; juniper and laurel berries bruised, each four ounces, boiled in eight quarts of water to six, and strained, fomenting with two flannels, by turns, as warm as convenient, morning and evening. A pint of British brandy may sometimes be added. While using, it should be kept warm over a chafing-dish. The remaining liquor may be put again on the herbs, for next day's use.

In the case of a seminal gleet in horses, from plethora and want of exercise, venesection, mild purgatives, alterants, and regular attention to cleanliness, are necessary.

Here Mr. Lawrence has an useful remark, which is, that stallions are more liable to grease and foulness than geldings.

BLEYME, in *farriery*, an inflammation in the foot of the horse, occasioned by extravasated blood about the inner part of the coffin towards the heel, between the sole and the coffin-bone. Farriers distinguish three sorts of bleymes; the first, which is found in spiked, wrinkled feet, with narrow heels, is usually seated in the inward or weakest quarter: the second is that which infects the gristle, and must be extirpated as in the cure of a quitter-bone. See *Quitter-Bone*. The third is occasioned by small stones or gravel getting in between the shoe and the sole of the foot. In the cure of this kind it is necessary to pare the foot, let out the matter, if any be formed, and dress the sore as for a prick of a nail.

According to Mr John Lawrence, "the preventive remedy, in these cases, is the new style of shoeing. If the bruise appear dry, with no tendency to suppuration, extirpate it by degrees with the knife, or rub in frequently some spirituous application, such as turpentine and camphorated spirits mixed; and nature will in time outgrow the blemish: should the horse travel tender, apply a light bar-shoe. In case of suppuration, make a small opening for the matter, and stop with pledgets laid one over the other, dipped in the proper digestive, warm. In narrow heels, cut away the horn which presses upon the bleyme."

BLIGHT, a general name for various distempers incident to fruit-trees as well as corn.

The trees are affected variously, the whole plant sometimes perishing by it, and sometimes only the leaves and blossoms, which will be scorched and shrivelled up, the rest remaining green and flourishing. Some have supposed that blights are produced by an easterly wind, which brings vast quantities of insects' eggs along with it, from distant places. These being lodged upon the suface of the leaves and flowers of fruit-trees, cause them to shrivel up and perish.

Mr. Knight says, that blights in fruit-trees, are produced by a variety of causes, by insects, by an excess of heat or cold, of drought or moisture; for these necessarily derange and destroy the delicate organisation of the blossom: but he believes the common opinion, that they arise from some latent noxious quality in the air, or from lightning, to be totally unfounded. The term *blight* is very frequently used by the gardener and farmer, says he, without any defined idea being annexed to it. If the leaves of their trees be eaten by the caterpillar, or contracted by the aphis; if the blossoms fall from the ravages of insects, or without any apparent cause, the trees are equally blighted: and if an east wind happen to have blown, the insects, or at least their eggs, whatever be their size, are supposed to have been brought by it.

The true cause of blights seems to be continued dry easterly winds for several days together, without the intervention of showers, or any morning dew, by which the perspiration in the tender blossom is stopped; and if it so happen that there is a long continuance of the same weather, it equally affects the tender leaves, whereby their colour is changed, and they wither and decay. The best remedy perhaps is gently to wash and sprinkle over the tree, &c. from time to time with common water; and if the young shoots seem to be much infected, let them be washed with a woollen cloth, so as to clear them, if possible, from this glutinous matter, that their respiration and perspiration may not be obstructed. This operation ought to be performed early in the day, that the moisture may be exhaled before the cold of the night comes on: nor should it be done when the sun shines very hot. Another cause of blights in the spring is said to be sharp hoary frosts, which are often succeeded by hot sunshine in the day-time. This is the most sudden and certain destroyer of fruit that is known.

In order to cure this disease, some advise the burning of wet litter on the windward side of the plants, that the smoke of it may be carried to them by the wind, which they suppose will stifle and destroy the insects, and thereby cure the mischief. Others direct the use of tobacco-dust, or to wash the trees with water wherein tobacco-stalks have been infused for twelve hours; which they say will destroy those insects, and recover the plants. Pepper-dust scattered over the blossoms of fruit-trees, &c. has been recommended as very useful in this case; and there are some who advise the pulling off the leaves that are affected.

The nature of this vegetable disease in grain has lately undergone further investigation, and various useful observations on the subject laid before the public, by the Rt. Hon. Sir Joseph Banks, who states, that

"botanists have long known that the blight in corn is occasioned by the growth of a minute parasitic fungus or mushroom on the leaves, stems, and glumes of the living plant. Felice Fontana, he says, published in the year 1767, an elaborate account of this mischievous weed, with microscopic figures, which give a tolerable idea of its form; and more modern botanists have given figures both of corn and of grass affected by it, but have not used high magnifying powers in their researches." But "agriculturists do not appear, he thinks, to have paid, on this head, sufficient attention to the discoveries of their fellow-labourers in the field of nature; for though scarce any English writer of note on the subject of rural economy has failed to state his opinion of the origin of this evil, no one of them has yet attributed it to the real cause, unless Mr. Kirby's excellent papers on some diseases of corn, published in the Transactions of the Linnæan Society, are considered as agricultural essays." On this account he offers to the consideration of farmers, engravings of this destructive plant, made from the drawings of the accurate and ingenious Mr. Bauer, botanical painter to his Majesty, accompanied with his explanation, from whence it is presumed that an attentive reader may be able to form a correct idea of the facts intended to be represented, and a just opinion whether or not they are, as is presumed to be the case, correct and satisfactory. But, in order to render this explanation more easy to be understood, it is necessary to premise, he says, that the striped appearance of the surface of a straw which may be seen with a common magnifying glass, is caused by alternate longitudinal partitions of the bark, the one imperforate, and the other furnished with one or two rows of pores or mouths, shut in dry, open in wet weather, and well calculated to imbibe fluid whenever the straw is damp. And it is added, that "pores or mouths similar to these are placed by nature on the surface of the leaves, branches, and stems, of all perfect plants, a provision intended no doubt to compensate, in some measure, the want of loco-motion in vegetables. A plant cannot, when thirsty, go to the brook and drink, but it can open innumerable orifices for the reception of every degree of moisture, which either falls in the shape of rain and of dew, or is separated from the mass of water always held in solution by the atmosphere; it seldom happens in the driest season, that the night does not afford some refreshment of this kind, to restore the moisture that has been exhausted by the heats of the preceding day."

It is "by these pores, which exist also on the leaves and glumes, it is presumed, that the seeds of the fungus gain admission, and at the bottom of the hollows to which they lead, as shewn in *pl.* XI. *figs.* 1, 2. they germinate and push their minute roots, no doubt (tho' these have not yet been traced) into the cellular texture beyond the bark, where they draw their nourishment, by intercepting the sap that was intended by nature for the nutriment of the grain; the corn of course becomes shrivelled in proportion as the fungi are more or less numerous on the plant; and as the kernel only is abstracted from the grain, while the cortical part remains undiminished, the proportion of flour to bran, in blighted corn, is always reduced in the same degree as the corn is made light. Some corn of the last year's crop (1804) will not yield a stone of flour from a sack of wheat; and it is not impossible that in some cases the corn has been so completely robbed of its flour by the fungus, that if the proprietor would choose to incur the expense of thrashing and grinding it, bran would be the produce; with scarce an atom of flour for each grain." It is further added, that "every species of corn, properly so called, is subject to the blight; but it is observable that spring-corn is less damaged by it than winter, and rye less than wheat, probably because it is ripe and cut down before the fungus has had time to increase in any large degree.—Tull says, that "white cone or bearded wheat, which hath its straw like a rush full of pith, is less subject to blight than Lammas wheat, which ripens a week later." The spring wheat of Lincolnshire was not in the least shrivelled last year (1804), though the straw was in some degree infected: the millers allowed that it was the best sample brought to market. Barley was in some places considerably spotted, but as the whole of the stem of that grain is naturally enveloped in the hose or basis of the leaf, the fungus can in no case gain admittance to the straw; it is however to be observed, Sir Joseph says, that barley rises from the flail lighter this year than was expected from the appearance of the crop when gathered in." And, that "though diligent inquiry was made during the last autumn, no information of importance relative to the origin or progress of the blight could be obtained: this is not, he thinks, to be wondered at; for as no one of the persons applied to had any knowledge of the real cause of the malady, none of them could direct their curiosity in a proper channel. Now that its nature and cause have been explained, we may, he conceives, reasonably expect that a few years will produce an interesting collection of facts and observations, and we may hope that some progress will be made towards the very desirable attainment of either a preventive or a cure." He further states, that "it seems probable that the leaf is first infected in the spring, or early in the summer, before the corn shoots up into straw, and that the fungus is then of an orange colour; the Abbé Tessier in his Traité des Maladies des Grains, p. 201, 340, tells us, he says, that in France this disease first shews itself in minute spots of a dirty white colour on the leaves and stems, which spots extend themselves by degrees, and in time change to a yellow colour, and throw off a dry orange-coloured powder; after the straw has become yellow, the fungus assumes a deep chocolate brown: each individual is so small, that every pore on a straw will produce from twenty to forty fungi, as may be seen in *plate* XI. and every one of these will no doubt produce, at least, an hundred seeds; if then, says he, one of these seeds tillows out into the number of plants that

appear at the bottom of a pore in *plate* XI. *figs.* 1, 2, how incalculably large must the increase be! A few diseased plants scattered over a field must very speedily infect a whole neighbourhood, for the seeds of fungi are not much heavier than air, as every one who has trod upon a ripe puff-ball must have observed by seeing the dust among which is its seed, rise up and float on before him. How long it is before this fungus arrives at puberty, and scatters its seeds in the wind, can only be guessed at, he supposes, by the analogy of others; probably the period of a generation is short, possibly not more than a week in a hot season: if so, how frequently in the latter end of the summer must the air be loaded as it were with this animated dust, ready, whenever a gentle breeze accompanied with humidity, shall give the signal to intrude itself into the pores of thousands of acres of corn. Providence, however, careful of the creatures it has created, has benevolently provided against the too extensive multiplication of any species of being; was it otherwise, the minute plants and animals, enemies against which man has the fewest means of defence, would increase to an inordinate extent; this, however, can in no case happen, unless many predisposing causes afford their combined assistance. But, continues he, for this wise and beneficent provision, the plague of slugs, the plague of mice, the plagues of grubs, wire-worms, chafers, and many other creatures whose power of multiplying is countless as the sands of the sea, would, long before this time, have driven mankind, and all the larger animals, from the face of the earth."

He adds, that "though all old persons who have concerned themselves in agriculture remember the blight in corn many years, yet some have supposed that of late years it has materially increased: this, however, does not, he thinks, seem to be the case. Tull, in his Horse-hoeing Husbandry, *p.* 74, tells us, that the year 1725 "was a year of blight, the like of which was never before heard of, and which he hopes may never happen again;" yet the average price of wheat in the year 1726, when the harvest of 1725 was at market, was only 36*s.* 4*d.* and the average of the five years of which it makes the first, 37*s.* 7*d.*—1797 was also a year of great blight; the price of wheat in 1798 was 49*s.* 1*d.* and the average of the five years, from 1795 to 1799, 63*s.* 5*d.* It is supposed, that "the scarcity of the year 1801, was in part occasioned by a mildew, which in many places attacked the plants of wheat on the S.E. side only; but it was principally owing to the very wet harvest of 1800. The deficiency of wheat at that harvest was found, on a very accurate calculation, somewhat to exceed one-fourth; but wheat was not the only grain that failed, all others, and potatoes also, were materially deficient. The wheat of the last crop is probably somewhat more damaged than it was in 1800, and barley somewhat less than an average crop; every other article of agricultural food is abundant, and potatoes one of the largest crops that has been known; but for these blessings upon the labour of man, wheat must before this time have reached an exorbitant price."

It is stated, that "the climate of the British isles is not the only one that is liable to the blight in corn; it happens occasionally in every part of Europe, and probably in all countries where corn is grown. Italy is very subject to it, and the last harvest of Sicily has been materially hurt by it. Specimens received from the colony of New South Wales shew that considerable mischief was done to the wheat-crop there in the year 1803, by a parasitic plant, very similar to the English one." And "it has been long admitted by farmers, he says, though scarcely credited by botanists, that wheat in the neighbourhood of a barberry-bush seldom escapes the blight. The village of Rollesby in Norfolk, where barberries abound, and wheat seldom succeeds, is called by the opprobrious appellation of Mildew Rollesby. Some observing men have of late attributed this very perplexing effect to the farina of the flowers of the barberry, which is in truth yellow, and resembles in some degree the appearance of the rust, or what is presumed to be the blight in its early state. It is, however, he thinks, notorious to all botanical observers, that the leaves of the barberry are very subject to the attack of a yellow parasitic fungus, larger, but otherwise much resembling the rust in corn." And "is it not, says he, more than possible that the parasitic fungus of the barberry and that of wheat are one and the same species, and that the seed is transferred from the barberry to the corn? Misletoe, the parasitic plant with which we are the best acquainted, delights most to grow on the apple and hawthorn, but it flourishes occasionally on trees widely differing in their nature from both of these: in the Home Park, at Windsor, misletoe may be seen in abundance on the lime-trees planted there in avenues. If this conjecture is founded, another year will not, continues he, pass without its being confirmed by the observations of inquisitive and sagacious farmers."

It is conceived "presumptuous to offer any remedy for a malady, the progress of which is so little understood; conjectures, however, founded on the origin here assigned to it, may, he thinks, be hazarded without offence. It is believed* to begin early in the spring, and first to appear on the leaves of wheat in the form of rust, or orange-coloured powder; at this season, the fungus will, in all probability, require as many weeks for its progress from infancy to puberty, as it does days during the heats of autumn; but a very few plants of wheat, thus infected, are quite sufficient if the fungus is permitted to ripen its seed, to spread the malady over a field, or indeed over a whole parish. The chocolate-coloured blight is little observed, says he, till the corn is approaching very nearly to ripeness; it ap-

* "This, though believed, is not dogmatically asserted, because Fontana, the best writer on the subject, asserts that the yellow and the dark-coloured blight are different species of fungi."

pears then in the field in spots, which increase very rapidly in size, and are in calm weather somewhat circular, as if the disease took its origin from a central position." And, "may it not happen, then, says he, that the fungus is brought into the field in a few stalks of infected straw uncorrupted among the mass of dung laid in the ground at the time of sowing? It must be confessed, however, that the clover-lays, on which no dung from the yard was used, were as much infected last autumn as the manured crops. The immense multiplication of the disease in the last season, seems, however, he thinks, to account for this; as the air was no doubt frequently charged with seed for miles together, and deposited it indiscriminately on all sorts of crops. It cannot however be an expensive precaution to search diligently in the spring for young plants of wheat infected with the disease, and carefully to extirpate them, as well as all grasses, for several are subject, he says, to this or a similar malady, which have the appearance of orange-coloured or of black stripes on their leaves, or on their straw; and if experience shall prove that uncorrupted straw can carry the disease with it into the field, it will cost the farmer but little precaution to prevent any mixture of fresh straw from being carried out with his rotten dung to the wheat-field." He conceives, that "in a year like the present, that offers so fair an opportunity, it will be useful to observe attentively whether cattle in the straw-yard thrive better or worse on blighted than on healthy straw. That blighted straw, retaining on it the fungi that have robbed the corn of its flour, has in it more nutritious matter than clean straw which has yielded a crop of plump grain, cannot, he supposes, be doubted; the question is, whether this nutriment in the form of fungi does, or can be made to agree as well with the stomachs of the animals that consume it, as it would do in that of straw and corn."

And it is further remarked, "that although the seeds of wheat are rendered, by the exhausting power of the fungus, so lean and shrivelled that scarce any flour fit for the manufacture of bread can be obtained by grinding them, these very seeds will, except, perhaps, in the very worst cases, answer the purpose of seed-corn as well as the fairest and plumpest sample that can be obtained, and, in some respects, better; for as a bushel of much blighted corn will contain one-third at least more grains in number than a bushel of plump corn, three bushels of such corn will go as far in sowing land, as four bushels of large grain." In proof of this position it is stated, "that eighty grains of the most blighted wheat of the last year (1804), that could be obtained, were sown in pots in the hot-house; of these, seventy-eight produced healthy plants."

As he conceives that "the use of the flour of corn in furthering the process of vegetation, is to nourish the minute plant from the time of its developement till its roots are able to attract food from the manured earth; for this purpose one-tenth of the contents of a grain of good wheat is more than sufficient. The quantity of flour in wheat has been increased by culture and management calculated to improve its qualities for the benefit of mankind, in the same proportion as the pulp of apples and pears has been increased, by the same means, above what is found on the wildings and crabs in the hedges."

The very intelligent writer concludes by remarking, that "it is customary to set aside or to purchase for seed-corn, the boldest and plumpest samples that can be obtained; that is, those that contain the most flour; but that this is unnecessary waste of human subsistence; the smallest grains, such as are sifted out before the wheat is carried to market, and either consumed in the farmer's family, or given to his poultry, will be found by experience to answer the purpose of propagating the sort from whence they sprung, as effectually as the largest." This interesting point probably requires the further investigation of accurate experiments, as observations have been recorded by practical agriculturists that make directly against it.

It is added, that "every ear of wheat is composed of a number of cups placed alternately on each side of the straw; the lower ones contain, according to circumstances, three or four grains, nearly equal in size, but towards the top of the ear, where the quantity of nutriment is diminished by the more ample supply of those cups that are nearer the root, the third or fourth grain in a cup is frequently defrauded of its proportion, and becomes shrivelled and small. These small grains, which are rejected by the miller, because they do not contain flour enough for his purpose, have nevertheless an ample abundance, it is supposed by the author, for all purposes of vegetation, and as fully partake of the sap (or blood, as we should call it in animals) of the kind which produced them, as the fairest and fullest grain that can be obtained from the bottoms of the lower cups by the wasteful process of beating the sheaves." These statements deserve the attentive consideration and examination of the inquisitive farmer, and if they be found on further experiment to be well founded, may lead to much economy in the management of grain.

The nature of this destructive vegetable malady, the causes of which have been so long involved in obscurity, will be still more clearly understood from the explanations given in the annexed plate, in which *fig.* 1, is a piece of the infected wheat-straw, the natural size: at *a* the leaf-sheath is broken and removed, to shew the straw which is not infected under it. *Fig.* 2, is a highly magnified representation of the parasitic plant which infects the wheat: *a* in a young state; *b* full grown; *c* are two plants bursting and shedding their seeds when under water in the microscope; *d* two plants burst in a dry state: *e* seems to be abortive; *f* seeds in a dry state; *g* a small part of the bottom of a pore with some of the parasitic fungi growing upon it. *Fig.* 3, is a part of the straw of *fig.* 1, magnified. *Fig.* 4, part of *fig.* 3 at *a b* more magnified. *Fig.* 5, part of a straw similar to *fig.* 3, but in its green state, and before the parasitic plant is quite ripe. *Fig.* 6, a

small part of the same, more magnified. *Fig.* 7, is a highly magnified transverse cutting of the straw, corresponding with *fig.* 4, shewing the insertion of the parasite in the bark of the straw. *Fig.* 8, a longitudinal cutting of the same; magnified to the same degree; and *fig.* 9, a small piece of the epidermis of a straw, shewing the large pores which receive the seed of the parasite; the smaller spots observable on the epidermis, are the bases of hairs that grow on the plant of the wheat whilst young, but which falls off when it ripens, magnified to the same degree as in the above figures.

Mr. Marshall, in the Rural Economy of the Midland Counties, observes, that it is well known that this disease is most injurious to grain-crops in wet seasons; hence, principally, the scarcity and advanced price of wheat after such seasons. It is also remarked to affect the north side of fields much more than the south, and that the effect is governed by the state of ripeness; consequently a few days of forwardness may be sufficient to prevent the effect. It is evident that the forward wheats are least liable to be blighted; for, having passed some certain stage of maturation, they become invulnerable to the attack of this mischievous enemy; at least no obvious injury is incurred. It is also observable that no perceptible blight takes place while a dry season continues. The only guard a farmer has against the attack of this secret enemy, appears to be that of sowing early.

M. Duhamel treats that part of this subject which relates to blighted corn, by dividing it into the following species, viz. empty ears, parched and shrivelled corn, glazed corn, abortive or rickety corn, barren corn, and fallen or lodged corn. See *Smut*.

BLIND, a deprivation of the sense of sight in any animal.

Moon-Blind, in *farriery*, a disease in the eyes of horses, the symptoms of which are mostly the forerunners of cataracts, and generally end in blindness. By the older writers on farriery, this disease was absurdly supposed to be influenced by the periods of the moon.

The symptoms of this disease, according to Signor Ricini, generally make their first appearance when a horse is turned five, coming six, at which time one eye becomes clouded, the eye-lids swoln, and very often shut up; and, for the most part, a thin viscid water runs from the diseased eye down the cheek, which is generally more or less in proportion as the eye and eye-lids happen to be more or less swelled and inflamed; and, in some constitutions, the inflammation is so great, and the humour so sharp and corrosive, that it scalds and fetches off the hair wherever it comes. The veins of the temples, and under the eye, along the side of the nose, are also turgid and full; others run but little, nor is the humour very sharp. This disorder is apt to come and go till the cataracts are perfect and ripe, and then all pain and anguish, and the soreness and running of the eyes go off with blindness when the horse is between seven and eight years old, this being about the time when most horses are spread and come to their full growth; so that from its first appearance to its completion is generally about two years and a half, during which time some horses have the returns of the disorder, not only more frequently than others, but the symptoms also more strong and violent. In some the eye is not much disturbed above a week, when it clears up again, and returns to its former state. In other horses the eye continues bad a fortnight or three weeks; and in others it is a month or longer before the disorder goes off, and the time of the return quite uncertain, sometimes sooner, sometimes later, according to the treatment the horse meets with from his farrier and keeper.

The disease is most liable to return in those horses which have their eyes strongly infected with a hot sharp humour that shuts them up with swelling and inflammation. But there is another kind of moon-blindness which is also the forerunner of cataracts, where no humour or weeping attends the eye. It is never shut up or closed, as in the case above described, but now and then looks thick and troubled, at which time the horse sees little, and perhaps nothing distinctly. Here the eyes always appear sunk and perishing, though the cataracts do not become so soon complete as in those that are full, and where a humour is predominant; nor is it unusual in this case for one eye to escape, whereby a horse may retain sight to guide him, so as to render him fit for common drudgery.

The causes of this distemper are various: it sometimes proceeds from a natural defect in the eyes; but in a horse that has naturally good eyes, and yet turns moon-blind, it is usually owing to sickness, or some malady that has terminated in the eyes, though we seldom see horses turn moon-blind, and breed cataracts, but where the eyes are naturally in fault. Those eyes are for the most part faulty that are very large and prominent, or very flat, small, and sunk, both which defects in the eyes of horses are liable to blindness, though they differ in their manner; and therefore colts that have large eyes, that run abroad, always feed with their heads downwards, and are continually exposed to the sun in hot weather, may easily contract an habitual weakness in their eyes. On the other hand, when the eyes are flat, and lie deep within their orbits, the surface of the eye being also flattish, the rays of light falling directly upon the pupil, and these not being sufficiently refracted, as they are in those eyes that are more convex, or of a rounder make, must needs weaken the eye, affect the optic nerve, and consequently weaken the tone of the muscles. And perhaps this may be the reason why the eyes perish and decay while the cataracts are growing.

The signs of this distemper may, in some measure, be deduced from what has been already observed; viz. swelling and inflammation of the eyes alternately, sometimes one eye, and sometimes the other, with a running of a thin watery serum, which is often so hot and scalding as to fret off the hair. In others the eyes run but little, and some not at all,

but look deadish, sunk, and perishing. In all moon-blind horses the eyes are sometimes tolerably clear, at other times thick and muddy, of a wheyish colour, or a dusky yellow; and when this happens, a horse sees but little; for when he is brought out into the light he takes little notice of any person or object that is near him, but always looks upwards, with his head raised, lifts his feet high, and sets them down with fear. Though in this distemper the humour sometimes shifts from one eye to the other by turns, and at some intervals seems to go off, yet when the eyes of such horses are at their best they look weak, and with a deadness; and when any such horse has his head held up, the weakness of the muscles, and of the whole eye, is easily perceived.

When this distemper happens to horses that have large full eyes resembling those of a calf, and when the humour continues by long periods, and the returns are frequent, there is great danger of blindness. If the eyes be of a moderate size, well formed, and the periods or returns of the distemper short; if the horse sees perfectly when the humour goes off, and the eyes in those intervals look clear, the horse may recover. When the humour attacks one eye, without changing to the other, there is also hopes of a cure, at least of saving one eye: but when the eyes look flat and depressed, and decay gradually, it is generally the forerunner of blindness: for in this case the nerves and muscles of the eyes are affected, and cataracts always form in the progress of the distemper. Here, however, as in the preceding case, when the distemper seizes only one eye, the other may sometimes be saved, and where this happens the remaining eye generally grows stronger: but when the distemper proceeds from a violent cold, as sometimes happens, whereby we often see the eyes swoln, and quite shut up, though the horse may be threatened with blindness by several returns, yet by good management it may sometimes be prevented, and the eyes recover. Nor does the distemper always prove incurable when the eyes are darkened with a yellow cloud, provided the eye be not naturally bad, and the above symptom of long continuance. In all cases of moon-blindness, the most promising signs of a recovery are when the attacks come more seldom, and their continuance grows shorter; or when the inflammation and swelling in those eyes, that are naturally full and large, abate. Also, when the eyes that looked sunk grow more plump and full; and when in either the corner looks clear and transparent, without muddiness, and the horse is more attentive to his way, and goes on without much fear or startling.

In respect to the method of curing this disorder, it must be observed that few moon-blind horses escape. Where the eyes are naturally defective, it is not advisable for any one to be at much expense and trouble to save them, as there is great reason to fear he will be disappointed. Sometimes, however, moon-blind horses, at least, such as have many symptoms of the kind, recover and do well, even beyond expectation. Where the eyes are large, full, swoln, and inflamed, the horse should be bled at proper intervals in the neck or about the eyes; but where the eyes appear sunk and perishing, bleeding, in the first case, should not be attempted. After bleeding, the following may be useful:

Take of red rose-buds two drachms, infuse them in half a pint of boiling water; pour off the infusion.

In four ounces of this infusion dissolve half a drachm of sugar of lead, and wash the horse's eyes, and all over his eye-lids, with a sponge, or a clean bit of rag, dipped in it, twice a day, till the heat and running of the eye abates, the veins sink, and become less apparent, and the eye begins to look clear. At the same time some lenient mild purges may be administered, such as the following:

Take of lenitive electuary and cream of tartar, each four ounces; syrup of buckthorn, two ounces; mix these with white wine and water, warmed, about a pint, and give it in the morning fasting.

Or, Take of lenitive electuary and cream of tartar, each four ounces; Glauber's salts, three ounces; solutive syrup of roses, two ounces; mix these with a pint of white wine and water, or warm water-gruel, and give them in the same manner.

Horses should have feeds of scalded bran while these lenitive purges are given them, and have moderate exercise, or be employed in any kind of easy business; for these draughts, for the most part, work off in about two hours. Where there is much tendency to inflammation, more active purges may be necessary, such as the following:

Take of succotrine aloes, half an ounce, or six drachms; cream of tartar half an ounce; jalap in powder, and salt of tartar, each one drachm; make the whole into a ball, with a sufficient quantity of oil of amber, and roll it in liquorice powder.

One of these balls may be given every week, in the manner of a common purge, with scalded bran; during its operation the horse should have his water milk-warm. The purges should be continued at proper intervals for a month or six weeks, and after omitting them a month to begin again; in all which time the horse may be kept in any common business, except hunting, going journeys, or other laborious exercise. In the intervals between the purges, it may sometimes be proper to give him an ounce of crude antimony every day, made into a fine impalpable powder, in one of his feeds, which may be continued for three months or longer. But where the horse is of great value, instead of crude antimony he may have the powders compounded of native cinnabar, or cinnabar of antimony and gum guaiacum, equal parts, giving him an ounce every day, till he has taken a pound or two; after an interval of about three months, to proceed in the same method till the eyes look strong and clear, and the horse shows no signs of blindness, or any defect in his sight, or weakness in his eyes. This method has frequently been attended

with success, where the eyes have been full, and no way perished. A pound of guaiacum wood, boiled in three gallons of water till it is reduced to two, is a cheap remedy, and may be profitably administered to horses of small value: it promotes perspiration, and strengthens the solids when relaxed. It may be given in the quantity of a quart or two every day in the horse's water.

But in cases where the eyes are sunk and perishing, and the eye-brows pinched at their inner corners next the nose, when there is little or no inflammation or running, except a more than ordinary moisture in the caruncle or haw of the eye, or where there is no moisture at all, a method of cure is required very different from the preceding. For as the nerves of the eye are affected, in this case it will be necessary to administer such things as have a tendency to attenuate and alter their condition, and thereby remove the cause of the complaint. This may probably be accomplished by the proper use of mercurials: remedies of the more mild kinds, such as purges, directed as above, may be first given by way of preparation, and then the following ball:

Take of calomel two drachms: of the conserve of red roses, and of wheat flour, each as much as may be necessary to make a ball.

Let it be given early in the morning fasting, tying the horse up from eating for two or three hours afterwards; then let him have a feed of scalded bran, with warm water or warm gruel to drink, which should be continued the whole time he is under this course of mercurial and purging physic. The ball may be repeated every other day till the horse has taken three or four, or even more, according to the circumstances of the case; at the same time the purge may be repeated occasionally, and the following lotion applied to the eyes:

Take of crude sal ammoniac, two drachms; dissolve it in a pint of warm water, or infusion of red rose leaves; and then add to it two ounces of spirit of wine or brandy, and two drachms of the tincture of opium, shaking them well together.

The eyes may be bathed with this solution two or three times a day; or it may be used by wringing cloths out of it, and applying them warm over the eyes.

Blind-*Nettle*, a provincial term applied to the wild hemp-plant.

BLINDNESS, in *farriery*, a deprivation or want of sight, originating from various causes. It is a complaint more frequently met with in horses than either in neat-cattle or sheep. And it is said to happen more especially to horses of an iron-grey, or dapple-grey colour, when ridden too hard, or backed too young.

Blindness *in Horses*, in *farriery*, a disease that may be thus discerned: the walk or step of them is always uncertain and unequal, so that they dare not set down their feet boldly when led in the hand; but when they are mounted by an expert horseman, and have much mettle, the fear of the spurs will frequently make them go resolutely and freely, so that their blindness can hardly be perceived. Another mark by which horses that have lost their sight may be known, is, that when they hear any body enter the stable, they prick up their ears, and move them backwards and forwards in a particular manner.

Blindness *in Sheep*, a complaint that sometimes occurs in these animals, from their being much exposed to either great dampness or long continued snows; in the latter case the effect probably proceeds from the reflected rays of light striking the eyes too powerfully.

BLISTERING, in *farriery*, the operation of stimulating the surface of some part of the body of an animal, by means of acrid applications, so as to raise small vesications upon it. In farriery, this is a method frequently employed for the purpose of removing local affections of different kinds, such as hard indolent tumors, and accretions.

Blistering *Ointment*, in *farriery*, a name given to a sort of soft ointment or plaster employed for blistering horses. The following is the method of preparing it:

Take of quicksilver one ounce; of Venice turpentine, one ounce and a half, rub them together in a mortar till the globules of the quicksilver disappear; then add of cantharides, in fine powder, three drachms; of sublimate, in fine powder, one drachm; of ointment of marsh-mallows and yellow basilicon, each two ounces: mix, and make an ointment.

BLOOD, in *farriery*, a red fluid circulating in the arteries and veins of animals, serving for the nourishment and support of them, and from which various secretions are formed.

Blood, like most other animalized matters, is an excellent manure for almost any kind of soil. The husbandman should therefore be careful to procure the offals of the shambles, as well as of the fish-mongers and other shops, where they are to be obtained, as, by proper attention in these respects, he may procure a great augmentation of most valuable manure.

Blood, *Full of*, in *farriery*, this is said of horses which are highly fed, and which have not sufficient exercise. It is sometimes the cause of outward swellings, frequently mistaken for the farcy.

Blood-*Horse*, a breed or variety of horses, supposed to be derived from the Arabian stock. They were formerly but little used, except for the purpose of the turf, and those of field-sports; but lately they have been found highly useful and advantageous for those of many sorts of light draught. Horses of the blood kind are found to acquire strength comparatively at a much earlier age than others, as it is usual to begin to race them at about two years old, but their future growth is considerably impeded by the violent treatment which they are obliged to undergo in training; and on this account they seldom arrive to a large size. But this circumstance should not discourage the breeding of blood-horses, for in their natural properties they are indubitably superior to all others. This superiority is not confined to internal or invisible causes only; but arises in a great measure also from the external conformation of their

bodies. The mechanical advantages which they derive from this source, consist in the great length of their quarters, and the depth and capacity of their chests; for in their relative proportion with horses of an ordinary species, they are not only much stronger, but possessed also of greater speed. According to Mr. Richard Lawrence, the most essential characteristic of this sort of horse, is compactness of fibre. This, he says, may be traced in every part, namely, skin, muscle, tendon, ligament, bone, and hoof. It is this property which increases his strength without adding to his bulk. Other parts, such as the brain, heart, and blood-vessels, are remarkable: the heart of the famous running-horse, Eclipse, weighed fourteen pounds. The texture of the skin also is finer, the hair softer, and the legs smooth and not tufted. And "the capacity of the cranium or skull, which contains the brain, is proportionably larger than that of the cart-horse; even the features of the face, viz. ears, eyes, and nostrils, are on a bolder scale." But his principal excellence arises from his powers of continuance, or of supporting fatigue.

It is observed by Mr. John Lawrence, that as the hips of the blood-horse are lower and narrower, proportionably, than those of the cart-horse, he is supposed to be weaker than the latter; but this is not, he says, the fact. "For if the croupe of a blood-horse be measured from hip to hip, the space will be found (proportionably) to be as large as that of a horse with wider and higher hips; because the surface is more circular, which, if extended flat, would occupy as wide a space. Hence it is evident that the blood-horse, in this instance, possesses as large a proportion of muscle, although it is concentrated into a circular form." These horses, though supposed to be deficient in bone, certainly excel in speed, strength, and bottom. And there can be no doubt but that the diffusion of racing-blood amongst the hunters, hacks, and coach-horses, must be highly beneficial in many points of view. See *Horse*.

Blood-*Hound*, a hound or dog, with long, smooth, and pendulous ears. When of the true breed, it is large, strong, and muscular, broad-breasted, of a stern countenance, of a deep tan-colour, and generally marked with a black spot above each eye. This was a dog of great use, and in high esteem with our ancestors; especially on the confines of England and Scotland, where the borderers were continually preying on the herds and flocks of their neighbours.

Blood-*Letting*. See *Bleeding*.

Blood-Running *Itch*, in *farriery*, an inflammatory or bloody kind of cutaneous disease or itch, arising in horses from being overheated by hard riding or other hard labour, shewing itself between the skin and the flesh, and making horses rub and bite themselves, and which, if let alone too long, sometimes turns to the mange. Besides the general remedies of bleeding in the neck-vein and scraping, there are various others employed by farriers; such as ointment with sulphur, murcury, &c. as well as alterative and purging remedies. See *Mange*.

Blood-shot, in *farriery*, a popular term for that red appearance which the eye exhibits when inflamed; or when the red globules of the blood pass into those vessels which usually convey lymph.

Blood-shot *Eyes in Horses*, in *farriery*, an inflammatory disease in the eyes of horses, arising from local or general causes. When from the first, topical bleeding may be the best remedy, but where it depends on the latter, general bleeding will be more advisable: purging occasionally may likewise be necessary, and on the days that those are not operating, diuretics may be given, such as nitre, to two or three ounces a day, in mashes of bran. The diet of the horse, if in the house, should be mashes of bran or scalded barley; and, while the inflammation is considerable, hay, oats, and all hard meat should be avoided; hard labour, and hanging down the head to graze, are hurtful in some cases.

Dipping a dossil of lint, or a very soft sponge, in the following eye-water, and washing the eye-lid with it two or three times a day, and, where opportunity favours, squeezing the sponge so as that a few drops may run into the eye each time, may be highly useful:

Take of red rose leaves dried, two drachms, infuse them in half a pint of boiling water until it is cold; then add to the strained liquor twenty grains of sugar of lead.

When the inflammation is nearly subsided, the following may be the most advisable for completing the cure:

Take of white vitriol, half an ounce; sugar of lead, one drachm; dissolve them in a pint of pure water.

Where the inflammation is of the topical kind, and the veins on the inside of the eye-lid are very full, much relief is given by opening one of the most turgid of them with a lancet.

But where there is much swelling, as frequently happens after blows, bites, &c. a poultice of scalded bran, or the crumb of white bread boiled, may be applied, and renewed as often as it cools, with more benefit. To this poultice a little of Goulard's vegeto-mineral water may also sometimes be added with considerable advantage.

In full habits, and where there seems to be naturally a weakness in the eyes disposing to this disease, recourse is sometimes had to rowelling, with great benefit.

The use of powders in eye-waters should not by any means be had recourse to where there is active inflammation, as in this state the eye is very tender, and the finest powder will irritate and inflame it, and occasion more or less pain; therefore, substances that admit of solution are more proper in such cases.

Blood-*Spavin*, in *farriery*, a dilatation and swelling of the vein that runs along the inside of the hock of the horse, forming a little soft tumor in the hollow part, often attended with weakness or lameness of the hock. The cure should be first attempted by bathing the part twice a day with vinegar or verjuice, or fomenting it with a decoction of oak-bark and alum boiled in verjuice, binding over it a roller of woollen cloth soaked in the same, which will contribute greatly to strengthen the part, and, if early applied, fre-

quently remove the disorder: but if by these means the vein is not reduced to its usual dimensions, the skin may be opened, and the vein tied with a crooked needle and waxed thread passed underneath it, both above and below the swelling, and the turgid part cut out, or suffered to digest away with the ligatures: for this purpose the wound may be daily dressed with lint, or some mild digestive application.

Blood, *Staling of*. See *Bloody Urine* and *Staling of Blood*.

Blood-*Stick*, in *farriery*, the stick employed to strike the fleam in the operation of bleeding animals.

Bloody-*Flux*, in *farriery*, a disease of the bowels of animals, which is attended with a frequent discharge of excrementitious and slimy matters. See *Diarrhœa* and *Dysentery*.

Bloody-*Urine*, in *farriery*, a disease frequently taking place in horses and other domestic animals, from falls, bruises, over-straining by hard leaps or hard-ran heats in racing, or other similar causes. In the cure some recommend to bleed, and give two quarts of milk, or whey, warm, with a gill of peppermint-water, and a strong decoction of two ounces of juniper-berries; Irish slate two drachms; sweetened with honey or syrup of quinces. It may be rendered more efficacious, by repeating and continuing it once a-day, with the addition of one ounce or two of armenian bole in powder; and two drachms to half an ounce of Japan earth.

The following restringent-ball may be given twice a-day:

Take of Peruvian bark, from half an ounce to one ounce; Lucatellus's balsam, or balsam of Peru, half an ounce; Irish slate, two drachms; elixir of vitriol, one drachm:

Make them into a ball with conserve of red roses, and syrup of poppies. The decoction of logwood and oak-bark, sweetened with honey, may likewise be given in doses of one pint.

BLOSSOM, a general name for the flowers of plants, but more especially of fruit-trees. The office of the blossom is partly to afford protection, and partly to draw or supply nourishment to the embryo, fruit, or seed. See *Orchard*.

Blossom, a colour in horses, formed by the intermixture of white hairs with sorrel and bay ones. It is sometimes called peach-colour.

Horses of this colour are said to be insensible and hard, both in the mouth and the flanks, and also apt to turn blind.

BLOWS, a provincial term used to signify the blossoms of beans, &c.

Blow, a kind of injury produced by any mechanical violence, applied to an animal. The effect of a blow is a bruise; and according to the degree or severity of it, and the importance and degree of sensibility of the part on which it fall, the extent of the mischief will be. The disorganization or derangement of parts that have sustained blows produce more or less inflammation, which is to be remedied in the different ways which are pointed out under the heads of *inflammation, wound*, &c.

Horses and other animals are very much exposed to blows upon the eyes, or eye-lids; and these are seldom so dangerous as might be apprehended: for sometimes an accident of this kind will cause great inflammation, and even make the horny coat of the eye turn white, and yet it will come to itself in a few days, only by bathing it with cold spring-water, by the help of a sponge, four or five times a-day, and especially if blood be drawn from any neighbouring vessel. If, however, the eye should become much swelled or inflamed, it will be proper to bleed the animal, and bathe with a warm decoction of poppy-heads, or with some cooling eye-water. For the remedies necessary in injuries of other parts from blows, see *Bruise* and *Contusion*.

Blow-*Milk*, the milk from which the cream has been blown off.

Blown, in *farriery*, a diseased state of the stomachs and bowels of cattle, caused by the sudden extrication of air in large quantities from some of the grosser kinds of green food. See *Hoven*.

BLUE-BALL, a name given in some districts of Somersetshire to cone-wheat, from the dark colour on the edge of the husks of the chaff, which cover the grain, from the falling off of the awns. See *Cone-Wheat*.

Blue-*Bells*, a common name given to a bulbous rooted plant of the hyacinth kind, frequently met with in woods and other places. Its root is said to answer as a substitute for gum-arabic, in the art of dying, merely by being simply dried and powdered. It is probable also, that it may serve other useful purposes.

Blue-*Bottle*, the name of a weed abounding in many corn-lands, flowering in July, and ripening its seeds in autumn. It is also known by the names of knap-weed, matfellon, and centaury. Mr. Miller asserts that the corn blue-bottle is an annual plant; but Mr. Ray and Mr. Lisle think its root perennial, because, as the latter observes, it not only puts forth new buds every summer at the root for the growth of the next year, but seems also not to seed early enough before the corn is cut to propagate itself by its seed in corn-lands, in which it most abounds, especially in gravelly soils.

Blue-*Milk*, such as has been skimmed, or had the cream taken off from it. In large dairies, it is chiefly used for feeding hogs.

Blue-*Stone*, in *farriery*, a popular name for the vitriolated copper, or Roman vitriol, of the shops.

BLYME, the same with bleyme. See *Bleyme*.

BOAR, the male of the swine-tribe of animals. See *Hog* and *Swine*.

A good boar should be firm, compact, well-made in his quarters, and be thick and well-grown about the neck and cheeks.

Boar, in *horsemanship*, is a term in which a horse is said to boar when he shoots out his nose level with his ears, and tosses his nose in the wind.

Boar-*Thistle*, a provincial term applied to the spear-thistle. See *Thistle*.

BOARD, a term applied to a thin flat piece of sawn timber.

Board *of Agriculture*, a board established in London in 1793, under the patronage of his Majesty, for the encouragement of agriculture, and internal improvement, consisting of a president, and thirty ordinary members, with proper officers for conducting the business of the institution.

The plan and design of this highly useful establishment, though, perhaps, previously suggested or hinted at by writers on rural improvement, was brought forward, and carried into execution by the unwearied efforts and persevering industry of Sir John Sinclare, to whom the nation is certainly under much obligation.

The advantages to be derived from an institution of this nature, were thus suggested by the patriotic Baronet, on his bringing forward the motion for its establishment in the House of Commons.

"In the first place, it might be considered as a general magazine for agricultural knowledge, and a board of reference, to which any question might be sent, connected with the improvement of the country. At present, government had no channel for obtaining information, respecting many points, in which the general interests of the country were deeply involved. Questions respecting commerce were referred to a Board of Trade, constituted for that express purpose; but no channel as yet existed for obtaining authentic information respecting the agriculture of the country, though undoubtedly of more general importance.

"In the second place, by agricultural surveys, carried on under the auspices of such a board, every fact or observation known in this country, connected with the improvement of the soil, or the stock it maintained, would soon be collected. The circulating of that information could not fail to be attended with the happiest consequences. The discoveries of one district, would be immediately communicated to another; a spirit of experiment would be excited; and every farmer in the kingdom would contribute his mite to the general benefit of his profession.

"In the third place, by establishing an extensive foreign correspondence, no improvement or discovery could be made in husbandry, in any quarter of the globe, that would not be immediately made known, and communicated to the people of this country, with much greater speed, and to greater advantage, than if private exertion and correspondence were alone to be depended on.

"In the fourth place, a public board might be entrusted with the privilege of franking, a point of very great importance, for without that privilege, it is well known that no information, however useful, except at an enormous expense, could be rapidly spread over the country. That was a privilege with which no private society could be invested, but to which a public body had the justest pretensions.

"In the fifth place, it was only through the medium of such a board, that any general improvement of stock could be looked for. Such improvement, however desirable, could not always be effected without concentrating the knowledge of a great number of individuals of different professions. In regard to sheep, for instance, the breeder, the grazier, the manufacturer of wool, the butcher, the currier, and the consumer, must all be satisfied, that a change in the breed of any particular district is calculated for their respective interests. So great an alteration in the opinions and the prejudices of great numbers of individuals, could only be effected by the authority and influence of a public board, and far surpassed the exertions of any body of private men, however active or respectable."

And "in the last place, such a board might be the means of obtaining a statistical account of England; and consequently of explaining the real situation of the country, in every point of view, that could possibly be wished for by a patriot or a statesman. Such an account of Scotland was already nearly completed, and specimens of it having been circulated abroad, it had received the most flattering marks of approbation. If in England, therefore, the same plan were executed, it would hardly be doubted that it would soon be universally adopted in every other country; and thus the principles of political society, and the sources of national improvement, would be more completely ascertained, than in any former period of history."

Many of these important advantages have been already accomplished, by the vast mass of facts that have been collected and presented to the public, in different publications, on the various subjects which the comprehensive nature of such an establishment naturally embraces, and much more may be expected from the future exertions of so enlightened and intelligent a society.

A full account of the nature, origin, and plan, with the charter of incorporation of this excellent institution, may be seen in the first volume of communications published by it.

BODY, in *horsemanship*, an indeterminate name given to that part of an animal which contains the principal viscera and organs of life. "The common appellation of this part, amongst horsemen," Mr. R. Lawrence observes, in speaking of the external conformation of the horse, "is the *carcase*. Thus a horse is said to be long or short in the *carcase*. A horse which is short in the carcase, is usually '*ribbed home*,' as it is termed, that is to say, there exists but a small space between the last rib and the hip-bone. This conformation is justly esteemed excellent. A horse thus formed is generally short in the back and wide in his loins, and better adapted to carry weight and bear fatigue than a horse of a different form." They are, however, "commonly supposed to be deficient in speed, from the idea that they have not sufficient length. But when it is considered that the trunk or body has no motion of itself, but is entirely acted upon by the quarters and extremities of the animal, it is manifest, he says, that the length should exist in these parts, and not in the body. In proof of this, two horses may be found

exactly of the same length from the point of the shoulder, at the chest, to the point of the buttock, and yet one horse may be long in the carcase, and the other short." The difference, he says, consists in the one having longer quarters than the other, and this, he observes, is undoubtedly the form to be preferred.

"The fore part of the carcase contains the heart and lungs, and should therefore, he says, be sufficiently capacious to admit of a free action in those viscera. Horses with flat ribs experience a greater pressure from the atmosphere in their breathing than those do which have their ribs more arched, consequently they are not so well adapted for respiration. The posterior part of the carcase contains the stomach and intestines, and is generally round and capacious in horses of a strong constitution. The back should sink in a small degree behind the withers, and proceed in a straight line to the end of the loins, and thence fall gradually to the tail. A hollow back renders the motion of the animal easier to the rider, but certainly cannot be so strong as one that is straight. A roach or hog back constantly throws the saddle forwards on the shoulders.

"The loins should be wide, and the hips low. The distance of the point of the buttock from the hip should be considerable. The lower part of the buttocks, in a posterior point of view, should be wider than the hips. The tail should issue from the croupe in a regular progressive curve, and not appear as if it was stuck into the rump.

"The hinder quarters may properly be considered as the main spring of the whole machine. This is clearly demonstrated by the superior size of the muscles, and the angular position of the thigh-bones.

"It has, he says, generally been the custom to attribute the source of motion principally to the fore quarters, under the idea that if the fore-quarters could move well and with speed, the hinder quarters must naturally follow. The fallacy of this doctrine may be easily exposed. In the action of a self-moving body, the posterior part generally constitutes the fixed point from whence the motion takes its origin. Thus, if the horse leans forwards, the centre of gravity ceases to be supported, and he is obliged to advance one of his fore legs in order to recover the equilibrium. Again, if the chief source of motion exist in the fore quarters, whence does it arise that many good fore-quartered horses are bad leapers? The reason is obvious: from weakness in their hinder quarters; for the principal strength of a horse lies in the muscles of his thighs. Therefore a horse may rise well at a leap, and clear it with his fore legs, but cannot bring his hinder legs over, unless the muscles of his thighs are sufficiently powerful. It may be urged that leaping differs from galloping; but galloping is, in reality, constituted by reiterated leaps on a plane surface. Hence the necessity of a good conformation in the hinder quarters." This doctrine is enforced by the conformation of horses the most celebrated for their speed.

Body *of a Horse*, the chest or most material part of a horse, usually denominated his carcase. See *Body* and *Carcase*.

When the body is compact and well made, he is said to be well carcased, or to have a good carcase. A horse is allowed to have a good body when he is full in the flank; a light body, when he is thin or slender in the flank. If the last of the short ribs be at a considerable distance from the haunch-bone, though such a horse may have a tolerable body for a time, if he be much laboured, he will lose it.

BOG, a quaggy sort of earth, generally met with in low situations, covered with coarse grasses, but of so little solidity as to be incapable of supporting the tread of heavy animals, caused by the dissolution, decay, and deposition of different vegetable and other substances, from the stagnation and detention of the water that oozes along on the clayey or other thin tenacious strata below, or which springs up through the fissures or other openings of them. They are of different kinds, depths, and consistencies, according to the different circumstances of the case, and the nature of the situation of the ground on which they are formed, as well as that of the earthy material that enters into their compositions. Dr. James Anderson, in his Treatise on draining bogs and swampy grounds, observes, that clay is a substance that strongly resists the entrance of water into it; but, when it is long drenched with water, it is, in process of time, in some measure, dissolved thereby, loses its original firmness of texture and consistence, and becomes a sort of semi-fluid mass, which is called a bog. And as these bogs are sometimes covered with a surface of a particular kind of grass, with very matted roots, which is strong enough to bear a small weight without breaking, although it yields very much, it is in these circumstances called a swaggle.

But, says he, whatever be the nature of the bog, it is invariably occasioned by water being forced up through a bed of clay, as just now described, and dissolving, or softening, if you will, a part thereof. He says, only a part, because, whatever may be the depth of the bog or swaggle, it generally has a partition of solid clay between the bog and the reservoir of water under it, from whence it originally proceeds. For, were not this the case, and were the quantity of water considerable, it would meet with no sufficient resistance from the bog, and would issue through it with violence, and carry the whole semi-fluid mass along with it. But this would more inevitably be the case, if there was at first a crust at the bottom of the bog, and if that crust should ever be broken; especially, if the quantity of water under it were very considerable. And as it is probable that, in many cases of this sort, the water slowly dilutes more and more of this under-crust, he makes no doubt but that, in the revolution of many ages, a great many irruptions of this kind may have happened, although they may not have been deemed of importance enough to have the history of them transmitted to posterity.

And it is remarked by Mr. King, in the Philosophical Transactions, No. 170, that the springs with which Ireland abounds are generally dry, or near dry, in the summer, and that grass and weeds grow thick about

the places where they burst out. In the winter, says he, they swell, run, and soften, and loosen all the earth about them. The sward or scurf of the earth, which consists of the roots of grass, being lifted up and made fuzzy by the water in the winter, (he has seen it lifted up a foot or two at the head of some springs) is dried in the spring, and does not fall together, but withers in a tuft, through which arises new grass; which is also lifted up the next winter. By this means the spring is more and more stopt, and the scurf grows thicker and thicker, till at first it makes that appearance which we call a quaking-bog; and as it grows higher and drier, and the roots of the grass and other vegetables become more putrid, together with the mud and slime of the water, it acquires a blackness, and grows into that which we call a turf-bog.

He however confesses, that there are quaking-bogs caused otherwise. When, says he, a stream or spring runs through a flat, the passage, if not kept open, fills with weeds in summer, trees fall across it and dam it up: then, in winter, the water stagnates further every year, till the whole flat is covered. Afterwards a coarser kind of grass shoots up peculiar to these bogs: this grass grows in tufts, its roots consolidate together, and its height increases every year, insomuch that he has seen it as tall as a man. This grass rots in winter, and falls on the tufts, and with it the seed, which springs up the next year, and so still makes an addition. Sometimes the tops of flags and grass are interwoven on the surface of the water, and this becomes by degrees thicker, till it lies like a cover on the water; then herbs take root in it, and by the matting of their roots it becomes very strong, so as to bear a man. He has gone on bogs which would rise before and behind, and sink where he stood to a considerable depth, under which was clear water.

He further observes, that Ireland abounds in moss more than any other kingdom: this moss is of divers kinds, and that which grows in bogs is remarkable. The light spongy turf is nothing but a congeries of the threads of this moss, before it be sufficiently rotten; the turf then looks white, and is light. He has seen it in such quantities, and so tough, that the turf-spades could not cut it. In the north of Ireland they call it old-wives tow, being not much unlike flax. The turf-holes in time grow up with it again; and all the little gutters in bogs are generally filled with it. To this he chiefly imputes the red or turf-bog; and from the same cause even the hardened turf, when broken, is stringy, though there plainly appear in it parts of other vegetables: and he is almost, from some observations, tempted to believe that the seed of this bog-moss begets heath when it falls on dry and parched ground. However, the moss is so fuzzy and quick-growing a vegetable, that it greatly stops the spring, and contributes to thicken the scurf, especially in red bogs, where he remembers to have observed this most particularly.

The situation of land may sometimes contribute to the formation of bogs in it, as flat spots of ground lower than the level of an adjoining river or lake; for when that part is filled up by the slime and earth brought from the surrounding grounds, and the rotten plants and animals, which are buried in it, have choked it up, it will become a bog; and then the water will continue to flow into it from the river or lake, especially when either of these is swelled by a fall of rain or melting of snow. These waters may also sometimes have this effect, without a communication above ground, by soaking through a sandy or gravelly soil. And another cause that may contribute to the production of bogs, may be the fall of a number of trees, which, by occasioning a stagnation in the water brought down from higher grounds, may cause the deposition of much earthy, vegetable, and other materials, and consequently the production of boggy appearances in the places where such obstructions are met with.

Bogs, *Draining of*, a method which is constantly necessary to be had recourse to in this sort of land. Wherever bogs are met with, draining is unquestionably the first step to be taken towards their improvement. For the full accomplishment of this purpose, Mr. Elkington's mode may in many cases be successfully resorted to, and with great and sudden effect; though the improver should not be too sanguine in his expectations, or imagine that it is in every case an easy operation to free this sort of land from an excess of moisture. There are probably some bogs which cannot, without great difficulty, be drained at all; and others that would cost the value of the land, in drains and machinery, to effect such improvements in them. But, notwithstanding unsuccessful trials may sometimes be made, the drainer ought not to be totally discouraged from further attempts, where there is a tolerable prospect of succeeding in the business at last; as the cases are no doubt very numerous, in which this sort of land may be effectually drained at an easy expense, and thereby brought from a state of inutility to yield considerable profit to the owners and the public. For such lands, when once laid dry, are highly productive. Bogs are of many different kinds, according to the nature of the wetness by which they are produced. See *Draining of Boggy Lands*.

Peat-Bog is that sort of bog which is principally composed of peat-earth. See *Bog* and *Moss*.

Quaking-Bog is such a kind of bog as, when trodden upon, affords an elastic kind of motion or shaking under the foot. See *Bog*.

Spring-Bog is such a bog as rises from the oozing or springing up of water through the stiff strata of materials on which it is formed. Mr. Elkington makes two classes of this sort of bog; the first of which is distinguished by the springs rising out of the adjoining higher grounds, in a regular line, along the upper side of the wet surface: while, in the latter, the number of springs that appear are not confined to one regular direction along the upper side, but burst out promiscuously over the whole surface, especially towards the lower side, forming quagmires all around that shake and bend under the feet like a suspended cloth, over which it is dangerous for the lightest cattle to pass, and which show themselves at a distance by the verdure of the grass, which the *quags* or spots immediately round the springs produce.

Turf-Bog, a sort of bog formed of materials of the nature of turf. See *Bog* and *Moss*.

Improvement of drained Bogs. It is observed in the appendix to Mr. Johnston's account of Mr. Elkington's mode of draining, that as the great object is, to get the ground brought to such a state, as to be fit for being laid down with grass-seeds, when it may be considered in such a state of improvement, that any subsequent crops will require no more than ordinary management to cultivate them, the first thing to be done after they have been well drained, is, where they are extensive, to have them divided into proper enclosures by open ditches, by which means much surface water may be carried off, as well as by properly attending to the formation of the ridges and furrows in ploughing, and giving them a direction towards the open ditches, by which the rain or surface water may be discharged as it falls; and after this has been effected, to have the surface well levelled by means of the spade, as being in most cases more effectual than by the plough. The better sorts of the materials thus removed may be mixed up with lime or other substances, and set upon the land, while those of the coarser kinds are made use of to fill up the inequalities on the surface. Paring and burning, where there is much coarse vegetable matter, may be practised with advantage. In order to this, whatever earth remains unemployed in filling up hollows should be burnt, together with that taken out of the ditches, unless the latter has been already carried off for fuel. The greater quantity of ashes there is, the greater will be the improvement of the soil itself, and the more will the earth be benefited. The ashes, after being well incorporated with the soil by means of light or superficial ploughing, frequently so enrich it, as to produce excellent crops for two years or more. The effects of the ashes and burnt materials have been said, in some cases, to be increased by the addition of a little lime. When the turfs have been reduced to ashes, spread over the surface of the ground, and turned in with a light furrow, turnips or potatoes ought to be the first crops. If the former, they may be sown broadcast, and fed off by sheep, by the dung and urine of which the soil will be greatly benefited, as well as by the refuse of the plants, and the consolidation of it produced by their treading upon it. It will then be in a state for a crop of oats or barley, which should be sown with grass-seeds, and well rolled down. The ploughing after the turnip-crop, thus eaten off, should be very slight, in order not to bury the enriching materials too deep; in which view oats ought to be preferred to barley. If the soil be full of the roots of rushes, weeds, and coarse plants, a summer-fallow may be necessary before any crop be taken; and when the ashes have been made in a particular part of the field, they may be spread over the surface before the seed-furrow is given, and the roots and tough clods, after being collected and burnt, may be spread along with them.

If the bog be very soft and deep of peat, so as not to admit horses for ploughing the first year, a crop of turnips broadcast may be got by sowing the seed among the spread ashes, harrowing it in with a light harrow and roller drawn by men. This crop being eat off, as above, will leave the land the ensuing year so much consolidated as to admit the plough.

When the surface has not been pared and burnt, fallowing for two years may be necessary, to reduce the soil to a proper mould, in the last stage of which the lime or other manure must be applied. In this case two white crops, with an intervening one of turnip, potatoe, &c. may be taken before the grass-seeds are sown. Boggy soil, of whatever kind, after being once broken up and pulverized by tillage and a course of fallow, should not be over-cropped before being laid down to grass, and when brought into a good sward of grass should not be too soon broken up again, but continue so, bush-harrowing and top-dressing it when the herbage begins to moss. Repeated rolling is also necessary in such soils.

It is probably a better practice to feed sheep the first and second years of the grass than cut it for hay, as it causes the roots of the grass to strike more horizontally through the soil, and more closely cover the surface. With this view a greater proportion of white and yellow clover and other short grass-seeds should be sown.

In the manuring of soft boggy lands some caution is necessary; for, though the ploughings previously to the application of the dung may be made deep with advantage, the subsequent furrows should be very superficial, and the dung regularly and uniformly blended with the soil; for, when this is not the case, it is apt to sink down too much, and be of little utility. The same thing takes place with respect to lime; and even when marle is buried too deep, it is said to lose its power as a manure.

On soft boggy ground, merely intended for pasture, nothing will produce a more rapid improvement than the application of a thin covering of marle. In order to this, whatever remains unemployed in filling up hollows should be burnt together with that taken out of the ditches, unless the latter has been already carried off for fuel. The greater quantity of ashes there is, the greater will be the improvement of the soil itself, and the more will the earth be benefited.

Marle, which is often found under a gravel or clay, may also be of great service; but if a loamy earth be near at hand, it will perhaps be less expensive to the farmer to bring such earth to cover the bog than it will be to dig up the clay. But of whatever kind the earth be which is laid upon the bog, the quantity should always be sufficient to cover its whole surface four, five, or six inches deep, according to the stiffness of the soil so brought.

Sea-sand, as being frequently mixed with shells, is well suited to this purpose, if the boggy ground be situated near the sea, so that it can be easily procured. The great weight of these materials tends equally to consolidate the bog, and press out the moisture from the spongy peaty earth; therefore the thicker they are applied the better. A slight sprinkling of lime over it will add to the effect, and bring up much white clover and other sweet grasses.

The most barren earths or soils, when used in this

way, may have good effects; but lime-stone gravel, where it can be procured, is to be preferred to all others. After the land has been treated in this manner, and lain some years in pasture, it may be broken up for tillage, and crops of grain taken before being laid down with grass-seeds. By ploughing, part of the natural soil will be turned up, and intimately mixed with the earth, &c. that has been laid upon it, and, if lime or dung be added, will together form a very fertile mould.

When boggy grounds are much over-run with rushes, and other coarse, sour, aquatic plants, scarcely any thing tends more to the first part of its improvement than that of stocking it hard with different sorts of cattle, but especially with sheep, as soon as ever it is sufficiently solid to bear them with safety: care must however be taken not to put them on till it is quite firm, as if that be done they will not only poach the surface, but the coarse herbage will remain without being eaten closely down. The practice of cutting the rushes frequently in their young and tender state, is also of considerable utility. By these means alone a better kind of herbage is speedily brought up, and much improvement produced.

Another considerable means of improving this sort of land, where the situation is such as to admit of it, as when it lies near the side of a large river or stream, of which, by means of proper dams and cuts, a command can be obtained, is that of floating it with water; a process that, when judiciously managed, never fails to produce abundant crops of grass. And that this is a mode of improvement well suited to this sort of lands, is evident from the effects that have been produced in different instances; and from the observations of Mr. Boswell, that they require more and longer watering than any sandy or gravelly soils: the larger the body of water that can be brought upon them the better; its weight and strength will greatly assist in compressing the soil, and destroying the roots of the weeds that grow upon it; neither can the water be kept too long upon it, especially in the winter-season immediately after the aftermath is eaten, and the closer it is eaten the better. The manner of conducting the business of watering must be suited to the circumstances of the particular cases. See *Irrigation* and *Watering of Land*.

After being thus improved, it must next be determined to what lasting purpose it may be best applied. The too great moisture of these soils, which always lie flat, renders them unfit for continued tillage, and their mould becomes so loose by frequent ploughing, that it frequently does not afford sufficient stability to the roots of corn. For this reason barley, oats, and rye do better here than wheat, which requires a firmer footing, but neither of them should be sowed thick; because the fruitfulness of the soil will always make up in the size of the plants, whatsome might think wanting in their number. The most beneficial method of employing this sort of land is, undoubtedly, by converting it into meadow; because, when thus prepared, and not injudiciously exhausted by crops of corn, it will yield great quantities of excellent grass. It is, however, usual to begin with sowing some kind of grain on this prepared surface, to indemnify the farmer by the plentiful crop which it generally yields; such, indeed, as sometimes defrays at once the whole expense of the improvement. In some cases the most profitable method may be to sow it in the autumn with rape, the leaves of which, shading the surface in hot weather, and rotting in the winter, contribute greatly to mellow the earth: the strong roots of this plant open the soil too, and its seed brings a great return when sold for making oil. One or two ploughings after this will prepare it for a crop of wheat. After this is taken off, and the stubble turned down, white clover and grass-seed sown, and the ground laid down for a lasting meadow; or if turnips be sown, or cabbages planted in the autumn, these in the spring may be succeeded by barley, with which the grass-seeds may be sown.

When, either through necessity for want of other arable land, or out of choice, the farmer intends to continue ploughing his improved bog, the surface must be raised in ridges, and the further management of it may be like that of most other ploughed grounds.

If a soil of this kind happens to be situated near a town, a greater profit may accrue from planting it with garden-stuff than from any sort of grain. Beans, peas, cabbages, potatoes, turnips, carrots, &c. are found to thrive exceedingly well in earth of this kind.

Bog-*Spavin*, in *farriery*, an encysted tumor, or a collection of brownish gelatinous matter contained in a bag or cyst, about the joints of the legs of horses.

The cure of this sort of tumor is frequently very difficult to be accomplished. Where blistering part freely, and the use of stimulant applications have been had recourse to without success, the disease will scarcely submit to any other method except that of firing, when the cyst should be penetrated to make it effectual; and in all obstinate cases that have resisted the above method, both the cure of this, and the swellings called wind-galls, should be attempted in this manner. If, from the pain attending the operation of dressings, the joint should swell and inflame, foment it twice a-day, and apply a poultice over the dressings till it is reduced.

BOIL, in *farriery*, an inflammatory tumor affecting cattle or sheep. In order to cure this sort of tumors, it will be necessary to bring them to a head by the application of plasters composed of wheat-flour and tar; and when they feel soft under the finger, to open them with a lancet, and let out the matter.

BOKE-LOAD, a provincial term applied to a top-heavy load.

BOLE, a term signifying the stalk or stem of a tree, and sometimes of corn.

BOLE, a measure of grain containing four bushels. It is a common measure in Scotland.

Bole *of Salt*, a measure that contains two bushels.

BOLING *of Trees*, the operation of taking off the heads and branches, and leaving only the boles or bodies.

BOLSTERS, in *horsemanship*, those parts of a great saddle, which are raised on the bows both before and behind, to rest the rider's thighs, and keep him in a posture to withstand the irregular motions of the horse.

BOLT, a term provincially applied to the trussing of straw.

BOLTER, a sort of framed sieve, having its bottom made of linen stuff, hair, or wire, according to circumstances. The bakers employ bolters that may be worked by the hand, but millers have larger ones that move by the machinery of the mill. It is sometimes called *Boulter*.

BOLTING, the operation of separating flour or meal of any kind from the husks or bran, by means of a bolter. It is sometimes written *boulting*. See *Bolter*.

Bolting-*Cloth*, linen or hair-cloth made for the purpose of sifting meal or flour through. They are made of different degrees of fineness, and numbered accordingly; hence we have cloths of No. 2, No. 3, &c. See *Bolter*.

Bolting-*Mill*, a mill or machine having much lateral or circular motion, by which means the business of sifting meal or flour can be performed with great facility and expedition. The framed sieve that moves within it is termed a bolter. See *Mill*.

Bolted *Flour*, such as has passed the bolter.

BOLTING, a term provincially used to signify a truss of straw.

BOLUS, in *farriery*, a well-known form in which medicines are administered. These are proper where great exactness is required in the administration, and where the speedily perishing drugs are to be used, as they are only made for immediate use. Many of the ponderous powders may more conveniently be mixed with mucilage, as they are thus the least bulky.

BONE, the hard brittle parts of animal bodies, which afford them form and support. All sorts of bones, fish-bones, hoofs, horns, or shavings of horn, are very useful for the purpose of manuring lands, when properly rasped or broken down into small pieces by other means, in order to undergo a speedy decomposition.

Chemical analysis has shown, that the constituent parts of bones are oil, alkaline salts, and animal earth, united with fixed air. The oil is in much greater proportion than the alkali, which renders bones rather a heavy manure.

They are used as a manure, both by themselves and with other substances. The common way of treating them is to break them with a mill into pieces about the size of a marble or nutmeg; they are afterwards laid upon the field in small heaps, at regular distances, and covered with earth; after remaining in this state for some time, they are spread on fallows, on grass, or on turnip-land.

It does not appear, however, that much trouble is taken in adapting them to the soil for which they seem best calculated, being laid indiscriminately upon lands of every description, and for the most part unmixed with any other substance. But, bones being kept together by fixed air, unless they are either laid upon soils possessing principles that are capable of depriving them of this air, or have something of that kind previously mixed with them, the texture of their parts will remain unbroken, and they will be of little utility.

At Sheffield it is a trade to grind bones for the farmer, who will give 16*d.* a bushel, and send sixteen miles for them. Some substance must then be mixed with them that is capable of dislodging the fixed air, and disuniting the principles contained in the bone. For this purpose nothing will be found so useful as quick-lime. Where there is no opportunity of grinding them, they may be mixed with lime in a heap, and will in this way soon be reduced to powder. It is also a judicious practice to mix ashes with them, a cart-load to thirty or forty bushels of bones; turning the whole when it has heated twenty-four hours: it may be laid on ten days after it has undergone this preparation.

Bones are sometimes burnt for the ashes, but this is a most wasteful practice, as in this operation they are freed from the oil and mucilage, and are merely phosphoric acid united to lime or phosphate of lime: in this state they are merely a stimulating manure, while in their unburnt state they are both nutritive and stimulating. Of all manures, bone is perhaps the most permanent. What has been said of bone in its recent and burnt state, applies likewise to horns, hoofs, and many other similar substances, as like bone they consist of phosphate of lime, animal oil, and mucilage.

When bones are used in their simple state, without the addition of earth or lime, they ought never to be laid upon any but the sharpest and most active soils, such as limestone, chalk, or gravel: upon all these they will meet with more or less calcareous earth, which will in some degree disengage their fixed air, and dissolve the oil contained in them; but upon deep clays, tills or loams, they should never be applied in that state. But when made into a compost, they may be applied with advantage upon soils of every description, by laying it upon or near the surface, when the crop is in a growing state. Upon wheat it should be used early in the spring without harrowing; upon barley and oats it may be harrowed in along with the grain. For drill-crops, such as turnips, beans, &c. they are particularly convenient, as they admit of being put into the drill at the same time with the seed, more readily than most other manures. In Hertfordshire, however, they are found to be an excellent manure for clay soils.

All kinds of bones will answer the purpose of a rich dressing, but those of fat cattle are unquestionably the best. The London bones are frequently boiled, and must therefore be much inferior to such as retain their oily and mucilaginous parts. Mr. Young, however, in his experiments on manures, detailed in the third volume of the Annals of Agriculture, says that the effect of the London bones was so very great, that he bought all he could get at 10*s.* 6*d.* a waggon-load of ninety-six bushels in London. With a dressing of twenty-five cart-loads the crop was superior to that which had fifty. The land was a mi-

arable soil, which, with a summer fallow, yielded but thirty bushels of wheat; but, with a moderate manuring of bones, yielded sixty-three bushels. On barley, he further observes, that bones hold a most decided superiority, and that, expensive as they are, they pay the farmer very amply.

Every kind of horny substances are useful manure when cut into small pieces; but in their natural state they produce little effect. The proportion proper to be employed varies with the size of the chips or shavings; fewer being necessary when small, but the effect of the larger are longer felt. If they are of a middling size, about sixty stones to an acre is a reasonable quantity. If more be used, the grain is said to be apt to be too luxuriant, and too long in ripening, also liable to be hurt by mildew. The small pieces, which are chiefly turner's shavings, are bought in London at 12*s.* or 13*s.* the quarter, and are much the most useful. The large ones, which are refuse pieces of horn, cost about 2*s.* less the quarter, and are generally ploughed in three months before sowing wheat or barley. They both answer in most soils and seasons, except very dry ones. Hoofs, as being of the same nature with horn, answer the same purpose as a manure.

Dr. Hunter, an ingenious physician at York, having laid down to grass a large piece of very indifferent limestone land with a crop of corn, selected three roods, which he dressed with bones broken very small, at the rate of sixty bushels to the acre. The crop of corn was greatly superior to the rest. The grass next year was also superior, and has preserved the same superiority ever since, insomuch that in spring it is green three weeks before the rest of the field. He dressed two acres with bones in two different fields prepared for turnips, sixty bushels to the acre, and found the turnips greatly superior to the others managed in the common way. He likewise dressed an acre of grass ground with bones in October, and rolled them in. The succeeding crop of hay was an exceeding good one. However, he has found from repeated experience, upon grass ground, that this kind of manure exerts itself more powerfully the second year than the first. He recommends the bones to be bruised by putting them under a circular stone moved round upon its edge by means of a horse, in the manner that tanners grind their bark.

In order to ascertain the comparative merit of ground and unground bones, he dressed two acres of turnips with large bones in the same field where the ground ones were used. The result of the experiment was, that the unground materials did not perform the least service, whilst those parts of the field on which the ground bones were laid were greatly benefited.

The following trials, inserted in the fourth volume of Communications to the Board of Agriculture, with bone-dust, or crushed bones, in the practice of Mr. Chatterton, seem, so far as they go, to show that this sort of manure is more useful on tillage lands than such as are in the state of sward. "He laid four quarters of crushed bones per acre upon one side of a field, which had been broken up the preceding year for oats, and that summer prepared for turnips; the remaining part of the field was dunged. The whole missed a crop, from the fly or slug destroying the plants; they were sowed a second and a third time; the last sowing was not destroyed, but it was so late in the season that no part of the field could get to perfection, none being of much greater size than a goose-egg, and therefore little or no difference was seen between one side of the field and the other. But the year following, when it was sown with oats and mixt grass-seeds, the part where the bone-dust was laid had greatly the superiority in colour, quality, and quantity; and ever after, as long as the writer occupied the land, the grass marked to an inch how far the bone-dust was sown. The soil of the whole field was a weakish gravelly loam."

"Another experiment with the same kind of manure, was made upon a meadow which lay low, and near a small river, and which in great falls of rain was flooded. The soil was a deep loam, the land sound and dry, except in a very wet season, yet the herbage was rather harsh and sharp, owing, perhaps, to a coldness below the surface from its low situation. It produced but little hay, and that not of a good quality, though from the appearance of the soil, &c. much better might have been expected. Upon a part of this meadow was sown the same quantity that had been sown upon the tillage, viz. four quarters per acre; they seemed to go well into the sward, so as to disappear, but when the mowing season arrived, to the writer's great surprise he could not perceive any advantage from the bones; yet not being willing to give up the experiment, he the year following sowed the same quantity he had done before upon the same land, not being sure that four quarters were enough; the result was, that he could perceive the gra - rather richer in quality, but very little increased in quantity; the meadow was continued in mowing so long as the writer occupied it, which was about six years, and he never experienced much variation of the bone-dressed land from the remaining part of the meadow. He had seen but little more advantage arising from bone-manure upon another person's meadow, which had been well manured with it, upon a different soil. These circumstances made him conclude that bones ought to be mixed with the soil by ploughing, and laid upon dry land, where they are of great service, and perhaps the most durable of any manure whatever, except marl, which in some instances is better."

Bone-*Dust*, the reduced state of bones, for the purpose of being applied to land. They should be more reduced where their effects are wanted immediately, but, in other cases, they need not be brought into so great a state of reduction. See *Bones*.

Bone-*Spavin*, in *farriery*, a boney excrescence, or hard swelling, taking place on the inside of the hock of the legs of horses.

Such spavins as begin on the lower part of the hock are said not to be so dangerous as those which put out higher, between the two round processes of the leg-bone: and such spavins as are near the edge

are not so bad as those which are more inward towards the middle, as they do not so much affect the bending of the hock. Spavins coming by kicks or blows have at first merely the appearance of bruises on the bone, or membrane that covers it, therefore are not of that dangerous consequence as when they proceed from other causes. Those that put out on colts and young horses are not in general so bad as those which happen to horses in their full strength and maturity. In very old horses they are generally incurable.

The usual method of treating these diseases is by blistering and firing, without any regard to the situation, or cause from whence they proceed. But if a fullness on the forepart of the hock comes on after hard riding, or any other violence which threatens a spavin, such cooling and repellent applications are the most proper as are recommended in strains and bruises. As those happening to colts and young horses are generally superficial, they require only the milder applications to remove them; for it is better to wear them down by degrees than to remove them at once by such severe means as are frequently used.

When a blister is thought necessary, the hair should be cut as close as possible, and then the ointment applied pretty thick over the part. This should be done in the morning, and the horse kept tied up all day without any litter till night, when he may be untied in order to lie down; and a plaster of some mild sticking substance may be laid over it, and bound on with broad tape, or a bandage, to keep all close. After the blister has done running, and the scabs begin to dry and peel off, it may be applied a second time in the same manner as before: the second application generally takes greater effect than the first, and in colts and young horses, for the most part, makes a perfect cure. When the spavin has been of long standing, it will sometimes require the blistering ointment to be renewed, perhaps, five or six times; but after the second application, a greater distance of time must be allowed, otherwise it might leave a scar or cause a baldness; to prevent which, once a fortnight or three weeks is often enough; and it may in this manner be repeated six or seven times without the least blemish, and will generally be attended with success.

The spavins that put out upon old or full-aged horses are apt to be more obstinate, as being seated more inward; and when they penetrate the joint, they are for the most part incurable, as they then lie out of the reach of applications, and are in a state of impenetrable hardness. The usual method in these cases is to fire directly, or to use the strongest kind of caustic blisters; and sometimes to fire and lay the blisters immediately over the part; but this way seldom succeeds further than putting a stop to the growth of the spavin, and is apt to leave both a blemish and stiffness behind; besides the great risk of injury by the use of applications of such a highly caustic and stimulating nature to the nervous and tendinous parts about the joints, by their exciting violent pain and inflammation in the limb. The best and safest way is, therefore, to make a trial of the blistering ointment as given under that article, and to continue it, according to the directions above laid down, for some months, if found necessary; the horse, in the intervals, working moderately. The hardness will thus frequently be dissolved by degrees, and wear away insensibly.

Even when the spavin lies deep, and runs far in the hollow of the joint, where it would seem that no application could reach it, and that neither firing nor medicines can avail much, farriers have sometimes succeeded in cases of this sort by the application of caustic ointments with sublimate, which act very forcibly, enter deep, and make a large discharge; destroying, by that means, a great part of the indurated substance, and dissolving away the remainder in a gradual manner. But whoever is acquainted with the nature of such medicines must know how dangerous in general their operation is on these occasions, and that a properly prepared cautery, made like a fleam, under the direction of a skilful hand, may often be applied with less danger of injuring the tendons or ligaments. When the last method is employed, after the substance of the swelling has been properly penetrated by the instrument, it must be kept running by precipitate mixed with the application used in dressing the part, or with a mild blistering ointment.

Where the spavin lies not deep in the joint, and yet the blistering method does not succeed, the swelling may be safely fired with a thin iron forced pretty deep into the substance, and then the part dressed as above directed.

BOORCOLE. See *Borecole.*

BOOSE, a stall for cattle to stand in; thus an ox or cow-boose signifies an ox or cow-stall, &c.

Boose-*Stake*, a provincial term applied to the stake, to which stalled cattle are fastened. It is in some districts called boosing-stake.

BOOSINGS, a provincial word used to signify the stalls of cattle.

BORDER, a term which signifies the portion of land next the hedges in fields; but in ploughed grounds mostly applied to the parts at the ends on which the teams turn.

It has been remarked by a late writer, that in many districts where the inclosures are small, they take up a tenth or twelfth part of the whole arable farms; and that in all situations they occupy a large space. It is justly conceived that, as such lands cannot be applied to the advantages of the fields themselves, they should be reduced as much as possible, permitting only just as much as is sufficient for the animals to turn upon at the ends of the furrows in ploughing, which, where only two horses are employed, need not be much. In many cases, this is, however, wholly disregarded, the rubbish of such borders spreading out to a considerable extent, and are mostly covered with various sorts of coarse plants, such as docks, thistles, thorns, brambles, &c. In most instances they are "found to be high, irregular ridges of land, from earth thrown out of ditches, and not carted away, and from the

turning of the ploughs and harrows, which carry out the soil with them; the proper season of bringing them into order is in February; and the best method to be used, according to Mr. Young, is first to cut all the wood, and make it into faggots, and then to grub up all the roots, and make them into stacks, for which work labourers are generally paid by the piece. It is proper to agree with them for raising the earth into a high ridge, in the middle of the border. In most counties, this will be done for 6s. to 10s. a stack, of the roots 16 feet long, 3 high, and 3 broad; but in others it may cost more. The earth then lies ready, and without any obstruction, for carting away, either to the field, to the farm-yard to make a compost, or for dung to be brought to it. But, in case one spit deep is not sufficient to make the border lower than the surface of the field, which it should always be, or, at the least, on a level with it, if it is grass-land; then it will be advisable to let the men who stub up the roots, leave it level, and set others to dig it to the proper depth. He has seen many farms so overrun with rubbish, that the borders occupy a considerable part of the whole. They then yield a very contemptible profit; for the product by wood that is spontaneously planted, and open to all cattle, is (consisting three parts in four of brambles and rubbish) of little value; upon the whole, no object, compared with the land lost. When cleared, and dug away to a proper depth, they are ready to be laid down for grass, so as to pay rent as well as the rest of the farm. In arable fields, the plough will advance much nearer the hedges than before, and yet leave space enough for a grass border. Such an object as this may appear trifling to some farmers, who have not attended to the great loss of land from this slovenly practice, but to good husbandmen, desirous of making the most of every part of their farms, it will not appear in such a light."

Grass borders in arable fields, are by no means advisable, as they are not only injurious to the hedges by the encouraging of coarse plants, but by the seeds which are disseminated over the tillage lands from them. Besides they are much easier kept clean by hoeing over annually, when kept dry, and which is of vast advantage to the hedges.

Where borders of this sort have been prepared in the above manner, in the preceding winter, they may be dug up in the following year, about March, in order to be planted with potatoes, as from the large quantity of decayed vegetable matter, they are generally in a proper condition for producing good crops of this sort. They are sometimes in these cases advised to be put in by means of the dibble, after the land has been dug over; but when the soil is inclined to be rather heavy, it is a much better method to set them on the fine mould in the bottom of the trench or furrow, to be covered by the succeeding ones, as dibbling never answers well on stiff lands. Where earthy or muddy materials have been raised from the ditches or ponds, and left to become mellow, a crop of potatoes may often be taken from them with advantage.

In some cases it is the practice with such borders to blend them up into composts, with well rotted dung and lime, placing them upon the other parts of the field for wheat or other crops. See *Headlands*.

BORD-LANDS, the lands or demesnes which, under the feudal system, lords kept in their own hands, for the maintenance of their boards or tables.

BORD-*Service*, the tenure of board-lands, by which, under the feudal system, the tenants were to procure provisions for their lord's tables. There are still some remains of this tenure existing; but the tenants pay only a small rent per acre, instead of finding the provisions formerly required.

BORECOLE, a species of cabbage, of which there are three sorts, namely, the common borecole, the green borecole, and the Siberian borecole, which is the curled colewort, by some called Scotch kale. It is sometimes written *Boorcole*. All these are for winter use, but the last is most esteemed. The two former are sown about the middle of April, and are fit for transplanting in about two months afterwards. When this is done, the plants of either of these sorts should be set, a foot asunder, in rows two feet distant from each other. They should not be eaten before the frost has rendered them tender; for, till then, they are tough and bitter. The Siberian borecole, which is extremely hardy, never injured by frost, and always sweeter in severe winters than in mild ones, need not be sown till the middle of July; and when the plants are strong enough for removing, that is, when they have six or eight leaves, they should also be set in rows, the distance between which should be about two feet, and that between the plants ten inches. These will be fit for use soon after Christmas, and continue good till April.

These kinds of plants, in order to be cultivated to much advantage, either as a food for man or animals, should have a good deep fresh soil, well loosened, by means of the plough or spade, to a considerable depth.

That borecole may be made use of as an article of fodder for cattle, where the land is suitable for its cultivation, is evident from the experiments of Mr. Baker, made long since, under the direction of the Dublin Agricultural Society, on a piece of ground that had been cropped the preceding year with potatoes; in which, after he had reduced the soil to a pretty good tilth, and manured it with a compost composed of earth, lime, and dung, he planted three rows of borecole plants, in ridges two feet asunder. On the 17th of August they were horse-hoed the first time, by taking off, at one furrow of the plough, only one side of each ridge close to the plants; in which manner they remained till the twenty-fifth, when he ran the plough again in the same furrow, by which, with the first furrow, he ploughed about twenty-one inches deep. This being finished, the earth was immediately returned to the plants, which afforded them fresh nourishment; and in order to give their roots time to penetrate this earth, which, by the horse-hoeing, was become very fine mould, he let them remain in this state till the 12th of September, when he horse-hoed them again, by taking off the

other side of every ridge; and on the 20th deepened the furrows in the same manner as the former, and immediately returned the mould to the plants; and on the 18th threw up a small furrow to each side of every ridge, which finished the culture, and restored the ridges to the form they were in when the borecole was planted.

On the 18th of December, Mr. Baker cut two perches in length of one of the rows of borecole, which contained twenty-one plants; they weighed one hundred and eighteen pounds, which is very near five pounds ten ounces for each plant: but he is inclined to believe that these plants will succeed as well if they are planted only eighteen inches asunder in the rows. However, at the above proportion, there would be seventeen tons and fourteen hundred upon an acre; but if the produce should be the same were the plants only eighteen inches asunder, in that case an acre would produce, by this culture, above twenty-three tons and twelve hundred.

He therefore concludes that this plant is worthy the farmer's or grazier's attention; for, as fast as it is cut, it will again, in about a month or six weeks, afford another crop. He has cut some of these plants two or three times, and found them excellent for the table as well as other purposes. For feeding cattle and sheep, he says, they are highly valuable, as no frost will injure them; and although the first crop amounts not to as many pounds upon any given quantity of ground as those of the common cabbage or the turnip-cabbage, yet the succeeding crops will, he believes, make their produce nearly, or quite, of equal weight with any other plants of the cabbage kind. But he observes, that as these plants afford only open leaves, and many of them very small, there will be a little more trouble in collecting and carrying them to the sheep and cattle than there would be with the other kinds.

It may not be improper to observe, he says, likewise, that upon the approach of spring, when they begin to throw out their spring-shoots for seed, if the large leaves have not been taken off for winter use, they will decay and fall off. He has not yet tried it; but he believes the best way of using this plant would be to allot one whole field to the culture of it, proportioned in size to the stock intended to consume the produce: and in September or October, to turn the ewes into the field for a few hours, morning and evening, and then to lodge them on any piece of grass or fallow which may want improvement, to which they will greatly contribute by emptying themselves upon it; and thus continue to turn them into the borecole-field till they have eaten all the luxuriant leaves; then let the plants rest a month, and there will be another crop. By having two small fields under this crop, he thinks that a stock of store-sheep might be maintained a whole winter at a very small expense; for, while the produce of one field would be consuming, the other would be coming on. This method occurred to him from an accident which attended his borecole. His cows got into the field, and presently devoured some of the leaves of the plants: these plants having engaged his attention afterwards, he soon found that they became quickly again in a very luxuriant state.

He recommends it to persons who may be able to put this scheme in practice before he can accomplish it himself, not to let the sheep pasture so long on the crop as to injure the stalks for want of leaves, as too great an injury done to the stalks may check, he thinks, the succeeding growth; which injury, he is inclined to believe, will not happen to the plants, at least not in so great a degree, whilst they have a sufficient quantity of leaves.

It will doubtless be observed, says he, that this scheme is confined to ewes or store-sheep: the reason for that is, that fat sheep should always have as much food before them as they choose to eat; and add to this that sheep, when they are fat, are more subject to be lame than store-sheep, to which ploughed ground will greatly contribute.

But notwithstanding these experiments, and the observations that accompany them, we believe that such plants can seldom be cultivated at so easy an expense as to be employed with advantage as articles for the fodder of sheep or other animals, except it be on particular soils and in extremely severe seasons, when turnips and other sorts of winter-food are greatly injured, and consequently not capable of being procured in sufficient quantities.

BORER, an instrument invented for the purpose of searching or exploring the nature of soils. This instrument is composed of two rods of iron, *pl.* II. *fig.* 10 and 11, each six feet long, and an inch in diameter. The end *a* of *fig.* 10 screws into the end *b fig.* 11, after taking out the stopper *c*, the use of which is to hinder either dirt or dust from getting into the screw. The screw is an inch and a half long, and three quarters of an inch in diameter: *d*, *fig.* 10, is a steel point somewhat blunt, to pierce the earth or any substance it may meet with. It should be about three inches long, and made with either three, four, or more, sides, as may be thought most convenient. It is screwed into the rod *a* in the same manner, and with a screw of the same size, as *a* is screwed into the rod *b*. It has a groove six inches long, a third of an inch wide, and three quarters of an inch deep, rounded in the bottom, and intended to bring up part of each different layer through which it passes. When springs are sought for, a bit of sponge is put into the groove. At the end *f* of the rod, *fig.* 11, is a screw to fix into another rod of the same kind, if it be found necessary to lengthen the instrument; and this may be repeated, by the addition of more rods, to any depth desired: *g h*, *fig.* 10, is the handle of this instrument, two feet and a half long: this handle is fastened to the rod by means of a clasp, *i*, lined with steel, fixed at one end by a hinge, and at the other by the screw *l*, so that it may be placed at any height. *Fig.* 12 is the handle separated from the rod, and marked with the same letters as before. *Fig.* 13, marked with the same letters as before, is another handle, or rather lever, like the handle already described, except its having only one branch, or lever, marked *g*. This serves to stop the borer when bringing it up from a considerable depth, and also

to screw and unscrew the several bars or joints as occasion requires, and to put on or take off the steel point at the bottom. The handle *g h*, *fig.* 10, is that by which the rod is held, and worked into the earth, either by twisting it round, especially at first, or, after it has penetrated to some depth, by lifting it up, and letting it fall again, which it does with such force as to pierce even the hardest rocks; especially if it work at any considerable depth, and has of course been lengthened accordingly; for every foot of this red weighs three pounds. Two men will easily sound the depth of twelve feet in less than a quarter of an hour, if they do not meet with many stones. When the rod becomes too heavy to be properly managed by hand, it may be raised by a rope fastened at one end to the handle, and at the other to a roller, or kind of windlass, erected at a proper height, perpendicularly over the hole, and turned with either one or two handles. This will cost but a trifle, and will easily raise the rod, which, when let go, will fall with such weight as to strike each time very deep into the earth. The Marquis de Turbilly observes, that he has seen it worked in this manner to the depth of more than a hundred feet.

The toughest iron is the best for making this instrument, which should be well hammered, till its surface is quite smooth and even; for the least roughness and inequality would occasion a friction, which would greatly retard its working. For the same reason, and also to increase the force of its fall, it is necessary that it should be perfectly straight; nor should it ever be struck with a mallet, hammer, &c. to force it down, because a blow might bend it, and it would easily break afterwards. The female screw must be turned like that in the breech of a gun-barrel, in a separate piece of iron, cross-ways to the grain; and this piece must be afterwards well soldered on to one of the ends of the rod. The reason for this is, that if the female screw were bored only at the end of the rod, it would by being hammered out in the same direction with the grain, be stringy and porous, and consequently so weak as to give way, or burst, in the working of the rod; whereas, when made of a separate piece, taken cross-ways of the grain, the threads of the screw will run with the grain of the iron, and be thence considerably strengthened. A bit, like that of an augre, proportioned to the thickness of the rod, may at any time, when necessary, be substituted instead of the steel point, to draw up a sample of the substance from the very bottom of the sounding.

If the only thing wanted be to know the nature of the under soil and layers of earth, so far as they may effect the vegetation of plants, it will be quite sufficient to bore eight or ten feet deep. A greater depth is only requisite when water, marl, ore, &c. is sought for.

The common augre will, indeed, do very well for shallow boring, as we have already observed under that article. See *Augre*.

By either of these instruments there is a certainty of discovering, without much charge or any hazard, not only what earths are under the upper soil, but also whether any other substance of value lies concealed there, such as marl, chalk, fullers' earth, fossile shells, coals, quarries of slate or stone, ores, &c. many of which lie hid and entirely unthought of in places where their value, was it known, would be ten times more than that of the estate which covers them.

Peat-Borer, a large sort of borer employed in peaty soils that are boggy, for the purpose of removing wetness. It has been used with advantage in some peat-mosses in Lancashire, by Mr. Eccleston. A representation of it is seen at *fig.* 14, *pl.* II. in which *a* is the cutter; *b* the body of the borer, six inches in diameter; *c* the aperture through which the peat is drawn out; *d* portion of iron bar, to which a cross-handle is fixed.

BORING, a practice sometimes employed in order to ascertain the nature of the different strata that lie beneath the soil; and also for the purpose of discovering springs, and tapping them, so as to draw off the water that injures the grounds below or in the neighbourhood. When this last object is in view, boring is generally performed in the bottoms of ditches or drains, previously made in the land, to the depth of several feet. See *Draining of Land.*

Boring, in *farriery*, an operation sometimes practised for the cure of horses whose shoulders are wrenched. This operation is performed in the following manner:—A hole is cut in the skin in the middle of the shoulder, and, with the shank of a tobacco-pipe, is blown as a butcher does a shoulder of veal; then a cold flat iron, like a horseman's sword-blade, is run eight or ten inches up between the shoulder-blade and the ribs, which is called boring; after that, the shoulder is burned round with a hot iron. This is a very absurd and cruel method of treatment, and which can be of no manner of service in lamenesses, or other cases of disease, where it is too often employed.

Boring-*Augre*, an instrument employed for the purpose of boring the soil, and letting off water confined beneath it, &c. See *Augre* and *Draining of Land.*

BOS, in zoology, is a genus of quadrupeds belonging to the order of *pecora.* The characters of which are taken from the horns and teeth. The horns are hollow within; and turned forward, in the form of crescents. There are eight fore-teeth in the under jaw, and none in the upper, their place being supplied by a hard membrane; and there are no canine teeth in either jaw. Six species are enumerated by Linnæus.

1. The *taurus*, which includes the bull and cow, and which has cylindrical horns bent outwards, and loose dewlaps. The bull, or male, being naturally a fierce and powerful animal, sometimes ungovernable, and often altogether furious. When chafed, he has an air of sullen majesty, and often tears up the ground with his feet and horns. The principal use of the bull is in propagating the species; for although he might be trained to labour, his obedience cannot be depended on. The bull, like the stallion, should be the most handsome of his species. Whatever the breed may be, he should be large, well made, and kept in good

heart; he should have a black eye, a fierce aspect, but an open front; a short head; thick, short, and blackish horns, and long shaggy ears; a short and straight nose, large and full breast and shoulders, thick and fleshy neck, firm reins, a straight back, thick fleshy legs, and a long tail well covered with hair. See *Bull*.

Castration has the power of changing the nature of this animal in a remarkable manner, giving him a great tendency to fatten: it destroys his fire and impetuosity, and renders him mild and tractable, without diminishing his strength; after this operation, his weight is increased, and he becomes fitter for the purposes of ploughing, &c. The best time for this operation in bulls is at the age of puberty, or when they are eighteen months or two years old. It is, however, common to castrate calves a few days after being calved. And after such an operation, they generally grow larger and fatter, and have more courage and activity, than those which are castrated at the age of puberty. When the operation is delayed till the age of six, seven, or eight years, they lose but few of the qualities of bulls; are much more furious and untractable than other oxen. See *Castration*.

The male calf, after being castrated while young, forms the ox, which is an highly useful animal for food and work. The *cow* is much more tame and useful, affording various products for the support of man. See *Cow*.

The colours of these animals are extremely various in the different breeds; but whatever the colour may be, the glossiness of the hair shows them to be in a healthy condition.

In regard to feeding, they soon fill the first stomach; after which they lie down to ruminate, or chew the cud. The first and second stomachs are continuations of the same bag, and very capacious. After the grass has been chewed over again, it is reduced to a kind of mass, not unlike boiled spinage; and under this form it is sent down to the third stomach, where it remains and digests for some time; but the digestion is not fully completed till it comes to the fourth stomach, from which it is thrown down to the bowels. The contents of the first and second stomachs are, therefore, a collection of grass and other vegetables roughly macerated; a fermentation however soon commences, which makes the grass swell. The communication between the second and third stomach is by an opening much smaller than the gullet, and not sufficient for the passage of the food in this state. Whenever then, the two first stomachs are distended with food, they begin to contract, or rather perform a kind of re-action. This re-action compresses the food, and makes it endeavour to get out; and the gullet being larger than the passage between the second and third stomachs, the pressure of the stomach necessarily forces it up the gullet. It is effected by a sort of inverted peristaltic motion. The action of ruminating, however, appears to be in a great measure voluntary; as animals of this kind have a power of increasing the re-action of their stomachs. After the food undergoes a second mastication, it is then reduced into a thin pulp, which easily passes from the second to the third stomach, where it is still further macerated; thence it passes to the fourth, where it is reduced to a perfect mucilaginous pulp, every way prepared for being taken up by the lacteals, and converted into nourishment. What confirms this account of chewing the cud is, that as long as these animals suck or feed upon liquid aliment, they never ruminate; and in the winter, when they are obliged to feed upon hay and other dry victuals, they ruminate more than when they feed upon fresh grass.

Bulls, cows, and oxen, are fond of licking themselves, especially when lying at rest. But this practice should be prevented as much as possible; for as the hair is an indigestible substance, it often lies in the stomach or bowels, and is gradually coated by a glutinous substance, which in time hardens into round balls of a considerable bulk, which sometimes kill them, and always prevent their fattening, as the stomach is rendered incapable of digesting the food so well as would otherwise be the case.

The age of these animals may be distinguished by the teeth and horns, as has been shown in speaking of the age of animals. See *Age*.

The bull, cow, and ox, generally live about fourteen or fifteen years; but are in general the most beneficial from three to five, six, or seven.

Ox-beef is probably most nourishing, but the flesh of a cow, when well fatted and young, is not much inferior. Bull-beef is hard, tough, and dry; for which reason it is not much used for food. Veal is well-tasted, easy of digestion, and rather keeps the body open than otherwise.

The best cattle of this kind are found in the northern parts of Europe. In general, they bear cold better than heat; for this reason they are not so plentiful in the southern countries.

The largest animals of this sort are to be met with in Denmark, Podolia, the Ukrain, and among the Calmuck Tartars; likewise those of Ireland, England, Holland, and Hungary, are much larger than those of Persia, Turkey, Greece, Italy, and Spain; but those of Barbary are least of all. In all the mountainous countries, as Wales, the Highlands of Scotland, &c. the black cattle are small, but hardy; and when fattened make excellent beef. In Lapland, they are mostly white, and many of them want horns. See *Cattle*.

2. The *bonasus*, which has a long mane; its horns are bent round towards the cheek, and are not above a span long. It is about the size of a large bull, and is a native of Africa and Asia. When enraged, it is said to throw out its dung upon dogs or other animals that annoy it.

3. The *bison*, which has likewise a long thick mane, that covers the whole neck and breast on each side. The horns are turned upwards, and exceedingly large; there is a large protuberance or bunch on the back; the eyes are red and fiery, which gives it a furious aspect. It is said to be fierce, cruel, and so bold that it fears nothing. It is a native of Mexico and Florida.

Doctor Anderson observes, that the bison of Louisiana, carries a fleece still closer, longer, and softer

than that of any of the varieties known in this country: it is not sleek and waved, but burly and close at the points, more nearly resembling the fur of other animals, or the wool of sheep, than other kinds of hair. This has been often shorn or plucked from the skin, and worked up into stockings and other useful fabrics as wool; but, more usually, the hide is dressed with the fur on it, and is kept as a wrapper for travellers, which, though weighty, is so extremely warm as to be much in use by all the persons who travel through the internal parts of America in winter, and well answers the purpose of blankets among the woods in those desert regions. This is an animal of great size, and ranges in vast herds in the large fertile plains on the banks of the Mississipi, where it often attains to such an unwieldly state of fatness, as to be unable to escape from the hunters, who slaughter them in great numbers, merely for the sake of their tallow, tongues, and hides, leaving the carcase as a prey to wolves and other ravenous animals.

Of its other qualities, particularly that of yielding milk, we are not as yet, he says, informed; as few attempts have hitherto been made to domesticate them, tho' this appears to be a task that may be accomplished with the greatest ease, by means of a natural instinct that seems to be in some measure peculiar to this animal; for when a female who has a young calf at her foot is killed, the calf, like the young elephant, and some other animals, will not desert her dam; nor does it attack her murderer, as the young elephant is said to do, but stands quietly by till the butcher has cut up the cow into quarters, and then follows whithersoever he chooses to conduct it."

This extraordinary fact is stated very circumstantially in a letter from Mr. Turnbull to Mr. Matthews, in the eighth volume of the Correspondence of the Society at Bath, who farther states, that "when trained up in a domestic way, it is extremely docile; and so strong, when employed in draught, as to exceed two oxen of the common breed of this country. These notices, the Doctor thinks, sufficiently point out this animal as a proper object for farther elucidation.

The *musk-bull*, of Hudson's Bay, which is said to be a variety of this species, wants the hump between the shoulders. It is about the size of a Scotch bullock; has a thick body, and short legs. The horns are large, and very remarkable: they are united at their origin in the skull; but immediately after, they fall down on each side of the crown of the head, then taper away small, the points turning up. The hair is black, and grows to a great length; underneath which is a fine wool, superior to Vigonia wool. The male only has the curious scalp; the female is covered with hair. These animals frequent the country about one hundred miles inwards to the north-west of Churchill-river, in Hudson's Bay, where they are very numerous.

"In its form, according to Doctor Anderson, it so nearly resembles a sheep, that were it not for the horns, which are short, and of a very particular conformation, it might naturally be taken for a sheep in preference to any other known class of animals. The body is every where covered with a thick and deep coat of hair, the roots of which are imbedded in a close fur or wool, remarkably fine, soft, and silky. The hair is so long as nearly to trail upon the ground as the creature walks. The wool of this animal is so soft and fine, that Mr. Graham caused some of it to be spun and wrought into gloves and stockings, which were warm and soft as fur, and lustrous like silk. They were so much coveted, that they had been all given away as presents before he had the pleasure of his acquaintance. A French gentleman presented to the Royal Academy at Paris, several years ago, some stockings and gloves that were made of the same material, which in softness, fineness, and lustre, were said to rival silk; so that there seems to be no room to doubt that it is of a very fine quality; and he is informed that the quantity is very considerable. The tail is covered with a particular kind of hair, of which the Esquimaux make great use in their manufactures, some of which are worked with a most amazing degree of delicacy. As to the other peculiarities of this creature, they are, he says, very little known. It is gregarious and active, going in great flocks together for a vast extent along those northern regions; and its flesh forms a principal article of subsistence to the inhabitants of Hudson's Bay, both natives and Europeans. If they be killed during the rutting season, the flesh is strongly tainted with a musky flavour, from whence it has obtained its name. This taint is not perceptible if it be killed at any other time, provided the heart be taken out immediately; but if that organ be left long in the body after death, it then also becomes tainted; otherwise the flesh is very pleasant. No attempt has hitherto been made to domesticate this creature; but there seems little reason to doubt, the Doctor says, that were the calves caught when very young, or cut out of the cows that were shot while very near the calving time, and carefully put to a domestic cow, they might be easily tamed, under a cautious mode of management. Unless it be in regard to the nature of the scalp, and the nature of its dung, which drops from the animal in the form of little hardish balls, resembling that of sheep, it is said to differ in no respect from other animals of the bos tribe."

4. The *grunniens*, or *hog-cow*, which has cylindrical horns bent backwards. The body is so hairy, that it hangs down upon its knees like a goat. The colour of the body is black, but the front is white. It has bristles on its back, tail, and hind legs, and it grunts like a hog. It is an inhabitant of the north of Asia.

We are supposed to have a variety of this species in the Indian-ox, which has a vast hump on the shoulders. They differ much in size, and in the form of their horns. Some are very large, and of a reddish colour; with short horns, and bending close to the neck; others very small, with horns almost up-

right, bending a little forward. In Surat, there is a minute kind not bigger than a great dog, which have a very fierce look, and are used to draw children in small carts. In Celebes there is a small species not bigger than a middle-sized sheep, called Anoa, very fierce and wild, of a dark ash colour, inhabiting the rocks. Mr. Loten, when in India, put some of them into a paddock, and in one night's time they killed fourteen or fifteen of his deer by ripping up their bellies.

There is another variety of this tribe, Doctor Anderson says, remarkable for its length of hair: "it is found in the higher parts of India, under the name of the *chittigong cow*, and is supposed to be merely the *sarluc*, or grunting ox of Thibet domesticated. With its distinctive qualities we are too little acquainted to be able to speak with confidence. All that is certain is, that, being a native of a cold climate, we have no reason to think it would not thrive here; and, being domesticated for profit, the probability is that it possesses some valuable peculiarities. It is said to be covered all over with a coat of very long hair, that hangs down below its knees. It is uniformly black all over, except the mane and tail, and a ridge down the back, which are white. The hairs of the tail are very beautiful, and are much prized over all India for fly-flaps; for which purpose they are mostly fitted to silver handles. In China, the hairs of the mane are dyed of a red colour, with which the natives form an ornamental tuft on the crown of their bonnets, so that it forms a beneficial article of traffic with that country. With the peculiarities of the rest of the fleece, he is entirely unacquainted."

5. The *bubalis*, or buffalo, which has large black horns bent backward and inward, and plain before. The hair on the back is very hard, but thinly scattered over the body. It is a native of Asia. But they are tamed in Italy, and are used for the same purposes as black-cattle in other countries. They draw carriages, and are guided by a rope tied to a string thrust through their noses. The buffalo is larger than an ox, has a thicker body, and a very hard hide. His pace is slow; but he will carry a great burthen. They feed in herds like cows; and yield plenty of milk, of which very good butter and cheese is made. Their flesh is pretty good, but not to be compared to beef. The wild buffalo is a very fierce and dangerous animal; he often attacks travellers, and tears them in pieces. However, they are not so much to be feared in woods as in the plains, because their horns, which are long, are apt to be entangled in the branches of trees, which gives those who are surprised time to escape. They are excellent swimmers, and will cross the largest rivers without any difficulty. They run wild in great troops on the coast of Malabar.

6. The *indicus*, or little Indian buffalo, has horns shorter than its ears, a bunch on its back, and no mane. It is about the size of a calf six months old, and used in the East-Indies for drawing coaches, and probably other sorts of carriages

BOTANY, the science which explains the nature and arrangement of plants, and all sorts of vegetable productions. It is a department of natural history that may be occasionally consulted by the agriculturist with much advantage and utility. On this subject, the writings of Martyn, Miln, and Withering, may be had recourse to with advantage.

Agricultural BOTANY, that part of the above science which relates to such plants or vegetables as have or may be made use of for the purposes of husbandry. It is a department of agriculture that has yet made but little progress, but which must be highly useful in various points of view to the practical farmer.

BOTS, in *farriery*, a kind of worms, very troublesome, and sometimes dangerous to horses.

When in large quantities, they are, according to Mr. Riding, "very destructive to horses, by depriving them of nutriment, preventing digestion, and injuring the stomach, in which they are generally found; and, as little has been offered to the public respecting their origin, and the means by which they are conveyed into the stomach, he first endeavours to point out the information which recent observation has furnished respecting them." He considers them as "a species of fly-worm, produced from the eggs of the *hæmorrhoidalis*, a two-winged fly, of the genus *æstrus*, and nearly of the size of the humble-bee, which deposits its eggs in the rectum of the horse, and occasions him great torment." He adds that, "the worms of the human subject have not been longer known to the world than those of the horse; and that the farriers, in all ages, who have undertaken the care of these valuable animals, have had some remedies for the long and short worm bred in their intestines. The short ones are the creatures here to be described; but though the world has so long been acquainted with their existence, it never knew their origin till M. Vallisneri discovered, of late, that they were produced from one of these flies, which insinuates itself into the fundament of the horse. These flies always live in the open field, and are seldom found near towns or houses; and this is the reason why those horses which are kept up in the stable in summer and autumn are scarcely ever found to be subject to these worms." He says, that "in the latter end of summer, and in autumn, these flies are found continually buzzing about the backs of horses in the open field, seeking an opportunity to deposit their eggs. Horses, at this season, are sensible of the business of this little annoyer, and have been seen, from the most quiet state, to jump, run about, and kick, only at the sound of the wings of one of these flies. This insect has been observed, when it has not succeeded in its first attempt, to fly with less noise towards a single horse in another part of the field, slily to creep under his tail, and to use some gentle titilation, in order to make the creature open his fundament; and, when a little open, has ventured to creep in, where she finds herself in a proper place for depositing her eggs. After this the horse has kicked and capered as if mad, and continued so for upwards of a quarter

of an hour. The worms hatched from these eggs soon, he says, find their way further up the intestines, and often penetrate into the stomach. After a sufficient time for acquiring their destined growth, they naturally quit the stomach, in order to get towards the lower part of the intestines, and are either voided with the dung, or of themselves crawl out."

It is observed that "there is nothing singular in the figure of these worms. They are larger than those of the common flesh-fly, and smaller than those of the ox-fly: they are somewhat of a conic figure, their heads being pointed, and their posterior part much larger; they are each provided with two crustaceous hooks, by which they lay hold, and pull themselves along, by that means, and adhere so firmly to the coats of the intestines, as to prevent their being forced out of their habitation by the fæces, before they are ripe for their chrysalis state. When these worms are only in small numbers in a horse, they do very little harm to the animal; but there are seasons in which they increase to such vast numbers, that they become a very fatal malady. In some years, when horses have died of a sort of epidemical disease, after they have been opened, prodigious quantities of these worms have been found living in their stomachs, each having formed a sort of a cell in its membranes, and all being lodged there, as close together as the seeds in a pomegranate. Nor need we wonder how such immense numbers should be found in one horse, since one female is able to deposit several hundred eggs. When these worms are fallen from the intestines, they crawl about till they find some place of safety, where they make a shell of their skin, and undergo all their changes; whence they finally come out in the form of their parent fly. From what has been said, it may, he says, be suspected, that all horses which have been at grass during the summer and autumn, have received a quantity of these worms into their intestines."

The season of their appearing is mostly about the months of May and June, after which they are seldom to be seen, and often do not continue in a horse above a fortnight or three weeks. They may be easily cured, when they are only in the straight gut, by giving the horse a spoonful of savin cut very small, once or twice a-day, in his oats or bran, moistened. Three or four cloves of garlick may also be sometimes added to advantage. The following purge may likewise be given:

> Take of Succotrine aloes, in powder, ten drachms; of jalap, in powder, one drachm; of long birthwort and myrrh, in powder, each two drachms; of oil of savin and amber, each one drachm. Make the whole into a ball with a little syrup.

When bots are lodged in the stomach they are more dangerous, sometimes causing convulsions, and are seldom discovered by any previous signs before they throw the horse into violent agonies. The only cure in these cases is by means of mercurial medicines. The following may answer the intention:

> Take of quicksilver two drachms; of Venice turpentine half an ounce. Rub them together in a mortar till no glistening appears. Then take of aloes an ounce; of grated ginger a drachm; of oil of savin thirty drops. Make the whole into a ball with a little syrup.

One of these balls may be given every two or three days, the usual precautions in regard to mercurial physic being attended to. Or, the following powders may be given every night in the corn, or in a mash:

> Take of tin, in powder, and æthiops' mineral, each an ounce. Make them into a powder.

These medicines, or any of the various preparations of sulphurated mercury, or antimony and mercury, may be continued several weeks together, in order to free the animal entirely from these worms.

If the horse be tender and weakly, and feed but poorly, the following stomach-drink may be of service:

> Take of gentian-root six ounces: of camomile-flowers two handfuls; of Peruvian bark two ounces; of juniper-berries four ounces. Infuse them six or eight days in three gallons of ale, shaking the vessel now and then; after which give a pint of the clear liquor two or three times a-day.

If the horse be strong, but hath worms from full and bad feeding, he may have given him with his corn a handful of rue, garlic, or savin, occasionally. The following bolus may also be of great service:

> Take of calomel half an ounce; of jalap, in powder, six drachms. Make a bolus with honey. Repeat a smaller dose in four or five days, or as occasion may require.

You may also add a purge of aloes with benefit.

Mr. Riding also advises the following:

> Take vitriolated quicksilver, one drachm; liquorice, linseed, of each, in powder, half an ounce: syrup or honey sufficient to form the mass; and divide into two balls.

And he recommends that "the horse should be put upon a diet of bran-mashes before this medicine is given; after which he should take one of these balls, and the other about forty hours afterwards. And when you have waited about the same time for the operation of the medicine, the following brisk purge should be given:

> Take Barbadoes aloes, from six to eight drachms; calomel, one drachm; Venice turpentine sufficient to form the ball.

He thinks that by paying proper attention to the operation of the above medicines, it may be judged whether it has the desired effect; but if, after it is over, it be suspected that there are still some worms remaining, a second course may be repeated in about a fortnight afterwards:—During the taking of the above medicine, the horse should, he says, be kept warmly cloathed, and his diet mashes, with gentle exercise. And when "the horse is affected with common worms, the above course of physic will, he thinks, be found equally efficacious for their destruction."

BOUDS, a name given in some districts to certain insects termed weevils, which breed in some kinds of grain, malt, &c.

BOUND, in *veterinary* medicine, a term of various application. Any part of an animal that is em-

braced with an unnatural force is said to be bound: thus horses are liable to be *hoof-bound*, *hide-bound*, &c.

Or the *bowels* may be constricted so as not to part with the fæces: in which case the belly is said to be *bound*. All these cases are explained under their proper heads.

BOVINE AFFECTION, a distemper of *neat* or *black-cattle*. It is a disease said to have been met with among black-cattle, caused by a worm lodged between the skin and the flesh, and perforating the same.

It is supposed by some to be caused by the *œstrum*, or vexatious fly, which pitches on the backs of cattle, and with a kind of sting, growing to its hinder part, perforates them, and into each perforation introduces an egg, which some time after grows to a worm, and this to a fly, which in due season is like its parent. When this fly pierces the skin, it causes severe pain. The worm, however, which is deposited, grows without any remarkable injury to the health of the animal: it never moves from its place, but in the following spring it occasions a tumor, out of which it finds its way, when summer approaches, and becomes a fly.

BOWELS, in *farriery*, a term employed to signify the intestines. The horse, and other quadrupeds, are liable to various diseases affecting these parts. See *Colic*, *Diarrhœa*, &c. They may be generally considered as arising from two causes, as inflammation, and spasm.

The signs by which inflammation of the bowels, in the horse, is to be distinguished from spasm, are the following: in the first the horse repeatedly lies down and gets up again, brings his head round often towards his belly, kicks his belly with his hind legs, is obstinately costive, feverish, and his pulse hard and frequent; while in the latter the pain only occurs at intervals, the animal's feelings are expressed more suddenly, he usually lies down during the spasm, and rolls on his back. In order to remove the former inject warm water very largely; avoid purging; bleed to three, four, or five quarts; inflame the skin of the abdomen or neighbouring parts by the most expeditious means. And in the latter, also, inject warm water; give opium and tartarized antimony, and diuretics, with aromatic substances. The first, when not speedily removed, soon terminates fatally.

Bowel-*Galled*, in *farriery*, a disease caused by the skin being abraded or rubbed off in some part about the belly. A horse is also said to be bowel-galled when the girth frets his skin, between the elbow of his fore-leg and his ribs. This may generally be removed by mild saturnine washes; or the common white ointment.

BOWLDERS, a term provincially applied to a kind of round pebble, common in the soils of the midland districts.

BOW-LEGGED, in *horsemanship*, is a defective conformation or posture of the fore-legs of a horse; produced naturally, or in consequence of his having been worked too-young. With this deformity, neither in the one case nor the other is the horse of any value, as he never can be sure-footed. Besides this, it is disagreeable to the eye; and may be known by looking at the two fore-legs, standing about three paces from his shoulder. If the knees project, and the legs turn in under him, so that the knees come further out than the feet, this is properly a bow-legged horse; though the term is no less applicable if the bone be curved in any other direction. Such a horse ought not to be taken for any service whatever, as he never can stand firm on his legs. No cure for this deformity has yet been devised by farriers.

BOWS *of a Saddle*, are two pieces of wood laid archwise to receive the upper part of the horse's back, to give the saddle its due form, and keep it steady.

BOX, a well-known hardy evergreen tree, of which there are two species, the large and the dwarf. The first sort, in suitable soils, such as dry chalky hills, sometimes grows to a considerable size.

The wood of this tree is very useful for turners, engravers, mathematical instrument-makers, and persons in many other trades, being so hard, close, and ponderous, as to sink when put into water.

These trees may be propagated by planting the cuttings in autumn in a shady border, observing to keep them watered until they have taken root; when they may be transplanted into nurseries, till they are fit for the purposes of being planted out. The best season for removing them is in October; though, if care be used to take them up with a good ball of earth, they may be transplanted almost at any time, except in the summer. These evergreens are very ornamental in pleasure-grounds, and will thrive on cold and barren soils, where few other plants grow. They may also be propagated by laying down the branches, or from seeds: the last is the best method to have them large. The seeds must be sown, soon after they are ripe, in a shady border, and be duly watered in dry weather.

Box *of a Wheel*, the aperture wherein the axis turns.

Box *of a Plough*, the cross-piece in the head of the plough which supports the two crow-staves. See *Plough*.

BRACE, a general name for a couple, or pair, of such animals as bucks, hounds, partridges, &c. It is also applied to any thing that serves to support any part of an implement.

BRACKEN, the same with brake or fern. See *Fern*.

BRAKE, the name of a wooden instrument used to bruise or break the bun or stem of hemp, flax, &c. in order to separate the cortical part or rind from it. See *Hemp*.

Brake, a term provincially employed to signify fern. It is likewise sometimes applied to the place where fern grows. See *Fern*.

Brake, a name given to an instrument used by farriers, &c. more generally called barnacles. See *Barnacles*.

BRAMBLE, a plant of the creeping kind, growing wild in hedges, having long trailing branches, armed with strong crooked aculei, or prickles.

It is observed by Mr. Somerville, in the second volume of Communications to the Board of Agriculture, that it has been recommended by many persons to mix brambles with hedge-plants, with a view to render them thicker and stronger, though there

may be some objection to the mixing of different kinds of plants in the same hedge, and to these plants in particular, as they send out numerous long shoots every year, which seldom live above two, or at most three, years, dying nearly in the same manner as the raspberry. In a hedge, therefore, where brambles are numerous, and have their branches interwoven with the other plants by the yearly decay of a certain part of their shoots, they soon fill the hedge with dead wood; which has not only an ugly appearance, but is also hurtful to the other plants of which the fence consists. Besides, the leaves of the bramble are so broad and numerous as nearly to deprive every other plant with which they are mixed of the benefit both of the sun and atmosphere. This, says he, is not opinion merely; it is confirmed by facts, as, in almost every case where there are brambles in hedges, they establish themselves at the expense, and in general the utter ruin, of every other plant. If the shoots of the bramble were like those of thorns, or indeed any other description of hedge-plants, and were capable of filling up the spaces they occupy, and of living for a number of years, a very good and handsome fence might be made with them, in conjunction with a railing, with which they might be warped. Such a fence, if the plants were sufficiently numerous, might be made in a couple of years; which, along with its enclosing the field, might become an object of profit on account of the fruit, which, when the plants are reared above the common surface, is very plentiful, and might be employed in making a species of wine or brandy; a thing which has been long known and practised in France.

And it is remarked, by a correspondent of Mr. Young's, in the second volume of the Annals of Agriculture, that the culture of the bramble, a plant universally looked upon as a very troublesome weed, is worthy the attention of every man who wishes to raise live hedges in a poor sandy soil, in a short time, at little expense. The idea of the utility of brambles, he says, first struck him from the following circumstances: several small enclosures were made in his parish, the soil of which was blowing sand, about eleven years ago, on each side of a narrow field-road, in which a large flock of sheep was frequently driven. On one side of the road the bank was planted with brambles mixed with the white-thorn, and a dead hedge placed on the top, as is the usual method: the dead hedge has never since been renewed, and the fence is now a tolerably good one. The bramble, which is a very fast grower, not only, he thinks, defends the young quick from the sheep, but likewise by twisting itself through the dead hedge, strengthens it, and prevents it from being broken down either by cattle or pilferers. On the other side of the road, the bank was planted at the same time, and in the same manner, with white-thorn only. The dead hedge has been renewed several times in that; and there is no probability that the white-thorn will ever make a fence. He has not been unmindful, he says, of the hint which the above observations suggested to him; but made what he thinks an improvement upon it, by planting two rows on the bank; the lower one of bramble only, the upper one of white-thorn only. He has tried this method in two years, and both fences are now much more promising than he could have expected them to be if planted with white-thorn only. He, however, only recommends this plant in poor sandy soils, where the growth of quick-hedges is slow; where they are liable to the depredations of sheep; and where, by reason of the looseness of the soil, the ditch is no defence.

When brambles are in considerable abundance, as is often the case on waste and other lands that require to be brought into a state of cultivation, they should always be grubbed up, and completely removed before any other improvement is attempted.

BRAN, the skins or husks that are separated from wheat, after being ground, by means of a sieve or bolter. Bran is an useful ingredient, when well scalded, and employed only occasionally in moderate quantities, for mashes for horses; but the constant use of it, whether raw or scalded, is prejudicial, as it is apt to weaken the horse's bowels, and thereby expose him to many disorders. It is also highly useful in stall-feeding cattle, and also for sheep, when given as a dry food.

BRANCH, the arm or bough of a tree; or that part which, sprouting from the trunk, helps to form the head or crown. It also signifies the part of a river sent off from a larger one.

Branches *of a Bridle*, are two pieces of iron bended, which in the interval between one and the other, bear the bit-mouth, the cross-chains, and the curb; so that on one end they answer to the head-stall, and on the other to the reins, in order to keep the horse's head in subjection.

BRANK, a provincial name sometimes applied to buck-wheat. See *Buck-Wheat*.

BRAWN, the flesh of the boar, after being boned, rolled up, or collared, boiled, and pickled. Brawn is made of the flitches, and some other parts; the oldest boars being chosen for the purpose, it being a rule, that the older the boar the more horny the brawn.

The method of making it is generally as follows: the bones being taken out of the flitches, or other parts, the flesh is sprinkled with salt, and laid in a tray, that the blood may drain off, after which it is salted a little, and rolled up as hard as possible. The length of the collar of brawn should be as much as one side of the boar will bear; so that, when rolled up, it may be nine or ten inches in diameter. After being thus rolled up, it is boiled in a copper or large kettle, till it is so tender that you may almost run a stiff straw through it; when it is set by till thoroughly cold, and then put into a pickle composed of water, salt, and wheat-bran, in the proportion of two handfuls of each of the latter articles to every gallon of water; which after being well boiled together, the liquor is strained off as clear as possible from the bran; and, when quite cold, the brawn put into it.

BREAD, a well-known kind of food, chiefly prepared from the flour of wheat. It is of various sorts, as white, wheaten, and houshold; differing only in degrees of purity. In the first all the bran is sepa-

rated; in the second only the coarser parts of it; in the third scarcely any at all; so that fine bread is made only of flour; wheaten bread of flour, with a mixture of fine bran; and houshold of the whole substance of the grain, without taking out scarcely any either of the coarse bran or fine flour.

We have also manchet, or roll-bread, and French bread, which are fine white breads made of the purest flour; and in roll-bread there is an addition of milk, and in French bread of eggs and butter. There is likewise ginger-bread, made of white-bread, with almonds, liquorice, aniseed, rose-water, and sugar; maslin-bread, made of wheat and rye, or sometimes of wheat and barley; and other breads, made with various substitutes for flour, as oat-bread, pea-bread, bean-bread, &c.

It is by means of yeast that the finest and lightest wheaten-bread is made. It often happens that bread made with leaven-dough has a sourish, and not agreeable taste; which may proceed from too great a quantity of leaven, or from leaven in which the fermentation has advanced too far. This inconvenience does not happen to bread made with yeast. Bread well raised and baked differs from unfermented bread, not only in being less compact, lighter, and of a more agreeable taste, but also in being more easily miscible with water, with which it does not form a viscous mass, which circumstance is of great importance to health.

The general process of making houshold bread is this: to a peck of meal or flour is to be added a handful of salt, a pint of yeast, and three quarts of water, cold in summer, but warm in winter, and temperate between the two: the whole being then kneaded in a bowl or trough, and a little more yeast added, rises in about an hour, after being set by in a proper temperature, according to the season. It is then moulded into loaves, and put into the oven to be baked.

For leavened bread, part of the flour intended for it being made into dough with warm water and a little salt, is laid in the rest of the flour an hour or more, in which time it rises to three times the bulk; then the whole is mixed and kneaded with more water till they be brought into a stiff dough; which, being formed into loaves, is baked in the oven: though the more usual way is to take a piece of dough kneaded, and leave it in the tub till next time, when it is broken small, and mixed with the meal, adding some yeast.

For French bread take half a bushel of fine flour, ten eggs, and a pound and a half of fresh butter; into which put as much yeast, with manchet; and, tempering the whole mass with new milk, pretty hot, let it lie half an hour to rise; which done, make it into loaves or rolls, and wash it over with an egg beaten with milk; taking care that the oven is not too hot.

Various interesting experiments have lately been made by the Board of Agriculture, in respect to the use of substitutes for wheat-flour, in the composition of different sorts of bread. For this purpose, all the sorts of grain commonly sold in the markets at London were procured, ground into meal, and baked in various mixtures into bread; as wheat, rye, rice, barley, buck-wheat, maize, oats, peas, beans, and also potatoes. Most of these sorts of grain form the principal nourishment of mankind in various countries; for, not to mention wheat, rye, and oats, on which so many thousands both in England and Scotland are supported, barley-bread is the common nourishment in many parts of Wales, in Devonshire, and Cornwall; and has been introduced with good success in various other countries; and, though a novelty, is highly esteemed in the county of Rutland. Buck-wheat made into thin cakes is the chief article of food in the Bretagne, part of Normandy, and part of North-America. Rice nourishes, probably, more human beings than all other articles of food taken together; and, for its bulk, is supposed to be the most nutritive of all the sorts of grain. Maize is a principal article throughout the South of Europe, and is made into bread in Italy, and in America. Peas and beans have rarely, it is believed, been used as bread; but, it is suspected, enter largely, though clandestinely, into its composition, in various districts. It is hardly necessary to mention what a valuable article of food potatoes are become in these as well as other kingdoms.

It is stated, that to ascertain the respective qualities of all these grains, and to discover their operation on each other, in correcting by means of one the defects of another, would be an inquiry that deserved great attention, and which has not yet been experimentally attended to. With almost all the several sorts of grain here detailed, experiments were made on seventy sorts of bread. But as all these sorts of bread were made at once, by several bakers, in order to be examined at the same time, the execution, it is observed, was by no means such as gave the Board satisfaction. One general result, however, was striking to many gentlemen who tasted them—that very few, if any, of the loaves, then exhibited, were too bad for human food in times of scarcity; and afterwards, when given to the poor, all of them were most thankfully received, and eaten.

Here it is observed, that though at first a change may prove disagreeable, yet the practice of a few days soon reconciles the stomach to almost any species of food, by which, at least in the same country, other individuals can be supported.

As these experiments were followed by others more satisfactory, it may be proper to explain, under distinct heads, the effects which have been remarked.

Rice.—Of all the mixtures, none has made bread equally good with rice, not ground, but boiled quite soft, and then mixed with wheat-flour. One-third rice and two-thirds wheat make good bread; but one-fourth rice makes a bread superior to any that can be eaten, better even than all of wheat; and as the gain in baking is more than of wheat alone, and rice to be had from the East Indies in any quantity, and so low it is said as one-penny three-farthings per pound, it appears to be an object of very great importance, more especially as there can be no doubt of the nutritive quality of it.

Potatoes.—The experiments that have been made on this root are numerous, and the result similar. It makes a pleasant palatable bread, with wheat in the proportion of one-third, but one-fourth still lighter and better. Specimens of barley and potatoes, and also of oats and the same root, made into bread, have been sent to the Board, which promise well. In some cases the potatoe was not boiled, but merely grated down into a pulp, and mixed with wheaten flour, in which mode it made excellent bread.

It has been found, by other trials than those of the Board, that good bread may be made from equal quantities of flour and potatoe-meal; which has been greatly the practice in those countries most remarkable for the plentiful culture of that root; but a more simple process is that of paring and boiling a quantity of potatoes, about one-third; rubbing them into dry powder; and afterwards mixing the flour and yeast; making it the same as if all of flour. Bread made this way is remarkably light, and keeps longer moist than any other sort.

Dr. Pennington of Nottingham observes, that various experiments have been made to combine the meal of wheat, barley, oat, bean, and pea-flour, with vegetable substances, and which have been found to produce very wholesome and nutritive bread. Potatoes, mixed with any of these substances, have been prepared in the following manner:—Take potatoes pared, and scraped or grated down, fourteen pounds; put them into an earthen or wooden vessel, and pour upon them two gallons of pure water; let the mixture stand about three hours; on pouring it off it will be found very thick, and with an earthy taste; pour on fresh water as before, changing it every three hours, till it becomes nearly clear and insipid, which it will be in from twenty-four to thirty-six hours, though forty-eight hours are required to produce the whitest pulp. This pulp appears to consist of two parts, viz. the white meal, which settles at the bottom, and of which starch, &c. may be made; and the upper part, which appears of a fibrous quality. Previous to the mixture of this pulp of potatoes with flour, the water should be pretty well drained from it, taking care that as little as possible of the mealy and fibrous part of the potatoe escapes with the water. The fourteen pounds of scraped or grated potatoe, thus purified from its earthy quality, weigh only seven pounds: this is to be mixed with fourteen pounds of the flour of wheat or barley: the yeast is then put in, and a small quantity of warm water; but milk is better. The dough, well worked up in the usual manner, to be set before the fire, covered up, till it rises, and then to be made into loaves to bake, and which, when returned from the oven, will produce thirty-six pounds of good bread.

The using the potatoes, after boiling, steaming, or baking, and reducing them into a sort of powder, seems, however, to be the most ready method of making them into bread.

Oats.—This grain is so well known in various parts of the kingdom, that the proper mode of using it is perfectly well ascertained. It appears, from some experiments made by Dr. Richard Pearson of Birmingham, that it answers better, mixed with potatoes, than has been commonly apprehended.

He finds that three pints (dry measure) of fine oatmeal, three pints of seconds flour, and one quart of potatoe pulp, kneaded into a dough, with a proper quantity of yeast, salt, and milk and water, make a bread of excellent quality.

Barley.—The Board have had no barley-bread before them that does not feel heavier in the hand than wheaten; but this is no proof against its nutritive quality: mixed with wheat, half and half, or potatoes one-fourth, and three-fourths barley, the bread is good. The following method of making bread of wheat and barley-flour has been strongly recommended to the Board.—To four bushels of wheat, ground to one sort of flour, extracting only a very small quantity of the coarser bran, add three bushels and a half of barley-flour, bolted through a twelve or fourteen shillings cloth. The oven should be hotter than when bread is made of wheat alone; and the loaves should remain in the oven three hours and a quarter. The offal of the barley is good food for hogs. This bread appears to be improved by being baked in half-gallon loaves. Even at the high price of wheat and barley in November 1795, this bread could be afforded at 17*d.* the gallon-loaf.

Rye.—In several parts of the kingdom, a mixture of rye and wheat is reckoned an excellent species of bread. In Nottinghamshire, opulent farmers consume one-third wheat, one-third rye, and one-third barley; but their labourers do not relish it, and have lost their *rye-teeth*, as they express it. As rye is well known to be a wholesome and nutritious grain, its consumption cannot be too strongly recommended.

The following mode of making a new kind of houshold bread, on a long trial, has been found to answer extremely well. Supposing a bushel of rye to weigh sixty pounds; to that add one-fourth part, or fifteen pounds, of rice. This is all ground down together; and, taking out the broad bran only, which seldom exceeds four and a half or five pounds for that quantity, it is thus prepared for houshold use. Fourteen pounds of this flour, when baked into bread and well soaked in the oven, will produce twenty-two pounds weight of bread, which is a surplus of three pounds and a half in fourteen pounds, over and above what is usually produced in the common process of converting houshold wheat-flour into bread. The astringent quality of the rice, thus mixed with rye, corrects the laxative quality of the latter, and makes it equally strong and nourishing with the same weight of common wheaten bread.

Indian Corn.—The flour of Indian corn, by itself, makes a heavy bread, in all the specimens yet produced to the Board. Anthony Songa, Esq. the Imperial consul, in particular, produced some made wholly of this grain, which was sweet and palatable, but crumbling. He informed the Board that the right mode of manufacturing it is, to boil the flour to the consistency of paste, and then, when mixed with wheat-flour, it makes excellent bread. The same idea had occurred to the Board, and was found to answer. If used by itself, it is said to have at

first a laxative effect; but that diminishes by use, and at any rate can easily be corrected by a mixture either of barley or rice.

It is stated, on very respectable authority, as the general opinion of the inhabitants of the United States, but more particularly of the people of Virginia, Maryland, Delaware, and Kentucky, where Indian corn is raised in the greatest quantity, and applied to the greatest variety of uses, that rather more substantial nutriment is contained in a bushel of Indian corn than of wheat. In the four states above-mentioned, it constitutes the almost entire food of the labouring class of the people, and has supplanted the use of wheaten bread.

There are several sorts of Indian corn in America. The yellow flinty corn is reckoned the sweetest and most nutritive. The white-ground corn of the southern states makes the fairest, but considerably the weakest flour. Of this last species there is one variety called the flour-corn, which is scarce, but very valuable.

The following is accounted the best mode of making bread of a mixture of Indian corn and flour: Let a given quantity of water be set over the fire, and when it boils, let the Indian meal be mixed with it, little by little, and constantly stirred, so as to prevent any lumps being formed, till, by the injection of the meal, a thick batter is made, like that of Scotch or Yorkshire pottage. This should boil over the fire for an hour, or an hour and an half, a small quantity of salt being previously thrown in. The wheaten flour, in the mean time, should be mixed with yeast, rather more than the usual proportion, in consequence of the mixture of the Indian meal. The batter should now be taken off the fire, and, when cooled to the degree of blood-heat, should be poured into the dough-trough with the wheaten flour and yeast. Having been made up into loaves, and properly kneaded, it should be suffered to continue longer in the oven than wheaten loaves. Bread thus made can be safely recommended, as certainly not less nutritious, and perhaps more palatable, when properly baked, than any other. In the shape of puddings and dumplins, this meal may also be used to great advantage.

Buck-wheat.—This is not kiln-dried, but in the sun, being reaped in October, a month remarkably dry and serene in America. The husk is taken off by what is called running it through the mill-stones. The farinaceous part of the grain is then easily separated from the husk by winnowing; and, being afterwards ground fine, forms an agreeable and nutritive aliment, and may be made into bread with wheat-flour or other substances.

Beans and Peas.—The Board have been informed, when these are used as bread, that in some places the wheat or flour is steeped in water, to take off the harsh flavour; and that afterwards, when mixed with wheat-flour, the taste is hardly to be perceived. Specimens of very good bread have been produced, mixed as follows: one pound bean-flour, one pound potatoes, and four pounds of flour. The flour or meal both of beans and peas, by being boiled previous to its being mixed with wheaten flour, incorporates more easily with that article, and is probably much wholesomer than it otherwise would be.

Horse-Bread. Horses are sometimes fed with bread, in order to improve their wind and strengthen them. The way to make bread for this use is this:

Take of wheat-meal, oat-meal, and beans, all ground very fine, each a peck; of aniseed, four ounces; of gentian and fenugreek, each an ounce; of liquorice two ounces; each beaten into fine powder, and sifted: to which add the whites of twenty new-laid eggs, well beaten up, and as much strong ale as will knead it: then make loaves like the house-bread, but not too thick; and let them be well baked, but not burnt. It should be given when not too new; and the horse may have it for five or six mornings together, without any other kind of provender. Or,

Take of wheat-meal, rye-meal, beans, and oatmeal, each half a peck, ground very small: aniseed and liquorice, an ounce of each; and white sugar-candy four ounces, in fine powder, with the whites and yolks of twenty new-laid eggs, well beaten: then add as much white-wine as will knead it into dough; which make into great loaves, and bake them well. When two or three days old it may be given to the horse: but the outside should be first pared or rasped off.

Race-horses have three sorts of bread, given successively, for the second, third, and fourth, fortnight's feeding.

1. Take three pecks of clean beans, and one peck of fine wheat: mix them together, and grind them into pure meal: after which bolt them pretty fine, and knead them up with a good deal of fresh barm, but with as little water as possible: labour it well in a trough; break and cover it warm, that it may swell; then knead it over again, and mould it into large loaves, in order to be well baked. When the loaves are drawn from the oven, turn them bottom upward, and let them cool. At three days old they may be given to horses; but not sooner, as nothing is more apt to surfeit them than new bread.

2. Take two pecks of clean beans, with two pecks of fine wheat, and grind them well together; then bolt and knead the flour with barm, and make it up as the above. With this bread, having the crust cut away, and oats, or split beans, mingled with it, feed the horses as before.

3. Take three pecks of fine wheat, and one peck of beans; grind and bolt them through a very fine bolter; then knead it up with very strong ale and barm, beaten together, and the whites of twenty eggs, or more, and no water at all, but a small quantity of new milk: bake and give it as above.

Bread-*Corn*, that sort of grain employed in the making of bread, or which forms the principal support of mankind. The great importance of this article to the welfare of society, renders it a matter highly interesting to ascertain the annual consumption; though too few data have yet been offered on many points, any calculation on this subject must of course be liable to much uncertainty; but as some facts are well known, a probable conjecture may

be formed, that may approximate somewhat near to truth, with regard to others, and the general result of the whole. It has been stated in the following way, in a valuable periodical publication, the Farmer's Magazine, printed at Edinburgh; supposing the population of Great Britain to be 10,000,000. The writer sets out by observing, that "the quantity of bread produced from a given quantity of grain, is known almost to precision, and this knowledge will be of some use in the investigation. Thus, in grain of a medium quality, a bushel of

Weight.		*Produce in Flour.*			
Wheat,	60*lbs.*	Of flour,	48*lbs.*	Of bread,	64*lbs.*
Barley,	48	meal,	$37\frac{1}{2}$	ditto	50
Rye,	54	ditto	42	ditto	56
Oats,	40	ditto	$22\frac{1}{2}$	ditto	30
Peas,	60	ditto	51	ditto	68

And he adds that, if "the quantity of bread used daily could also be known, it would much facilitate this enquiry. This, however, has not been altogether ascertained; but in one case it has long been known, and from it a probable conjecture may be formed of the rest, and it is this: In Scotland, "he believes, all over, a labouring man is allowed 2 pecks of oat-meal weekly for his food, amounting in weight to $17\frac{1}{2}$ lbs. averdupois, and this in addition to the beer, the milk, or the broth, which he gets along with it. This meal will produce $23\frac{1}{3}$ lbs. of bread, which is at the rate of $3\frac{1}{3}$ lbs. daily, or $53\frac{1}{3}$ ounces. When he is fed on wheaten bread, he gets 3 loaves a day, at from 14 oz. to 22 oz. weight each; for in this the practice is not uniform, but more generally 16 oz. than any, which makes 48 oz. daily. Such is the allowance to each reaper in harvest, and such is the quantity which a servant boarded in the master's house receives the whole year over; but when each labourer lives in his own house, with his wife and family around him, there is no doubt that he makes a quantity considerably less to serve, and which should be held in view, when forming an estimate of what the whole community at an average may consume yearly, supposing in this stage of the estimate, that all are fed on bread alone. It will be necessary, also, to make a distinction between the different classes, as composed of youth, able bodied, and superannuated, and even men from women, as these last are generally supported on a less mess. Having all this in view, he would conjecture, that all males, between the years of 10 and 50, would require 42 oz. daily, the females of the same age 35 oz. and all of both sexes below 10 and above 50, 28 oz. each. Now, says he, from the Statistical Account of Scotland, it appears that, in the whole community, the proportion in 1264 souls, is as under:

		Oz.
Males between 10 and 50	352 say at 42 ea.	14784
Females ditto	404 do. at 35 do.	14140
Both sexes below 10 and above 50	508 do. 28 do.	14224

Average of 1264 will be 1264(43148)34136

Here it is remarked that, "it is a curious fact, that the proportion between males and females *born*, is just the reverse of this, there being 35 males born for 31 females; whereas the proportion in actual existence as above, is 40 females to 35 males; hence, it should appear, that about 10 out of 45 males born, either leave the country, perish in battle, or are lost by shipwreck. Some few females also leave the country, or are lost by shipwreck, which will make the proportion still greater of males who disappear from the population."

But this allowance of 34.136 oz. daily of bread to each individual at an average, is made on the supposition, that the whole live upon bread alone, which is not by any means to be granted; for animal food was always to some extent, and is now, in considerable proportion, a part of the food of the people. How much this may operate towards a reduction in the use of bread, he has no particular data from which to estimate, but merely from conjecture, which to him seems probable. He should suppose that two-thirds of the people eat animal food daily, and that, in consequence thereof, they make use of only *one-half* of the bread which otherways must have been required for their subsistence; but that the remaining third part of the people depend almost solely upon bread, without receiving much of their subsistence from animal food at all: Hence, on this principle of calculation, one-third of the above allowance of 34.136 ounces, will, he says, fall to be deducted in estimating the average of bread made use of by the whole body of the people, making 22.75 oz. daily to each individual.

Now, if one person uses daily 22.75. oz.
10,000,000 will use 227,500,000, ozs.

	tons.	*cwts.*	*lbs.*
which is equal to	6347	13	14 in a day
or to	44,433	11	98 in a week
or	2,316,894	10	70 in a year.

The above, he observes, includes flour and meal from every description of corn used in the country. With regard to wheat, of which there is assuredly more used in the food of the people, than of any other species of grain, the quantity can perhaps be ascertained nearly to precision. Thus, he adds, the city of Edinburgh and country for six miles round is known, from actual survey, to contain about 110,000 inhabitants, and to use yearly about 165,000 bolls*, or 82,500 quarters of wheat; which is at the rate of 6 bushels for each person yearly; a quantity, he should suppose, that may be stated with a considerable degree of accuracy, as the average individual consumption of the whole nation at large; for although in Edinburgh itself, there is a consi-

* The Corporation of Bakers in the Royalty of Edinburgh use yearly about 55,000 bolls of wheat, and these are on good grounds supposed to take one-third part of all the wheaten bread in the city and about the district.

derable quantity of oatmeal used, and in a great proportion of Scotland, and a considerable extent in the west of England, and in Wales, the people live more upon oatmeal than wheat, yet as the great body of the English nation live altogether on wheaten bread, the estimate of 6 bushels yearly to each person, at an average all over Great Britain, seems probable to be neither a too great nor a too small allowance. Now 6 bushels is equal to 360 lb. of wheat; 288 lb. of flour, and 384 lb. of bread, which is at the rate of 16. 8 ounces of bread daily to each individual, at an average. Then, if one person uses this a day, 10,000,000 will use

	tons.	*cwt.*	*lbs.*	
10,520,584 lbs.	4696	13	52	in a day.
	32,876	14	28	in a week.
	1,714,285	14	52	in a year.
which is of flour	1,285,714	5	95	
and of wheat	1,607,142	17	16	

which, at 60 lb. the bushel, comes to 7,500,000 quarters.

And further he states, that "if we suppose, that, in a season of medium fertility, an acre (English) affords for bread, exclusive of the seed, 20 bushels; then, to produce the above, would require 3,000,000 of acres; and if the crop of 1799, confessed on all hands to have been a bad one, had been deficient to the extent only of 5 bushels the acre, the failure on 3,000,000 of acres, would amount to 1,875,000 quarters.

It has been "before calculated, that the whole bread of every description used in Britain yearly, amounted to 2,316,894 tons 10 cwt. 70 lbs: from this deduct the weight of wheat bread, as above, and the remaider, 602,608 tons, 6 cwt. 18 lbs. will, he says, be the quantity of bread made from other kinds of grain, such as oats, barley, &c. It will not be easy to ascertain the exact proportion that these different species of corn bear to each other in the above quantity of bread, but he should think that it would not be far from the mark, to estimate them in the following proportions in 10; viz. oats 6; rye 2; barley 1; and peas 1. Now, from the above statement, the respective weights of each will be as under:

				lbs.
6 Bush.	of oats	at 30 lb.	of bread each, will be	180
2 do.	of rye	at 56	do.	112
1 do.	barley	at 50	do.	50
1 do.	peas	at 68	do	68
10 in all, will average each				41,0

Now, continues he, if 41 lb. be accounted as equal to the bread from one bushel, the before-stated quantity, viz. 602,608 tons 16 cwt. 18 lbs. will be equal to the bread of 32,923, 10 bushels, or 4,115,378 quarters."

He proceeds to observe, that "the next point to be ascertained, and which it would be very desirable that it could be done with precision, is, how many bushels from each acre in cultivation, on the average of these last mentioned crops, are converted into bread? It must be obvious, that it can be but very few, as malt consumes almost the whole barley, and horses the whole beans, and a great proportion of the oats. He must here conjecture, in a great measure at random, and from a very limited knowledge of the fact, that each of these acres produces for bread, in a season of medium fertility, only one-fourth part of the quantity that is thus produced from an acre in wheat, or 5 bushels in all; thence the number of acres altogether thus cultivated will be 6.584, 602. To this add 3,000,000 in wheat, as before estimated, makes 9,584,602 acres altogether in Great Britain under bread-corn. It is generally supposed, that in England alone there are 2,000,000 of acres yearly in bare fallow, besides what is in turnip, potatoes, artificial grasses, and various other vegetables. Probably the whole lands cultivated by the plough, may amount in Great Britain to 15,000,000 of acres.

The whole surface has been calculated as under:

	Sq. Miles.	*Acres.*	*Low Country capable of Cultivation.*	*Hills and Mountains incapable of Cultivation.*
England and Wales,	55,924	35,791,360	28,633,085	7,158,275
Scotland	30,600	19,584,000	6,266,880	13,317,120
Total,	86,524	55,375,360	34,899,965	20,475,395

It has been stated above "that the quantity of wheat converted into bread in a year of medium fertility, (in which he also understands that the nation affords its own supply of corn,)

amounts to	7,500,000 quarters.
And of every other description of grain,	4,115,376 qrs.
Total required for bread,	11,615,376 qrs.

But this is neither all sent to market, nor is it all that the country produces; for, in the first place, there is included in it, all that the farmers themselves, and their whole body of labourers, (a very numerous class) require at home for their own subsistence, and which does not go to market at all; also the crop has other exigencies to provide for than merely bread-corn. There is indispensibly required *seed* for the following crop; *corn* to *feed* the *horses* who labour the land; corn to feed the horses in *every other*

department, and, what is perhaps more than any, malt for the breweries, as man cannot live by bread alone." What those may require, he now endeavours to estimate in detail, so far as he has data for the different cases; also the gross amount of the crop itself in a season of medium fertility. First, the amount of the crop—which he estimates from probable conjecture only, as precise data are altogether wanting,—he should suppose that wheat, rye, beans, and peas (all corn with little husk), will return per English acre $22\frac{1}{2}$ bushels; barley and oats, both coarser grain, 28. It has already been stated, that 3,000,000 of acres are required to be in wheat, and 6,584,602 acres in grain of all other kinds: then suppose $\frac{1}{4}$ of these to be in rye, beans, or peas, equal to 1,646,150, hence 4,646,150 acres, producing $22\frac{1}{2}$ bushels each, and the remainder 4,938,452, —producing 28 bushels the acre.

Next (and these particulars he states as in a great measure consistent with his knowledge), for every acre under a crop of corn, there will be required $3\frac{1}{2}$ bushels for bread to the farmer and his labourers; for seed 4 bushels, and for horse-corn $2\frac{1}{2}$ bushels, making 10 bushels in all, for what may be called *home-consumption* on the farm, and this, whether the crop be good, bad, or indifferent. This being premised, let us, says he, suppose a year of medium fertility, such as 1798, the produce and expenditure, therefore, of the crop would be as under:

	Quarters.
4,646,150 acres of wheat, rye, &c. at $22\frac{1}{2}$ bushels per acre,	13,067,297
4,938,452 do. of barley and oats, at 28 bushels per acre,	17,284,582
9,584,602 acres of land in bread-corn, producing in all	30,351,879

Disposed of as under:

1st. for seed to the next crop,	4,792,301	
2d. bread to the people } employed in husbandry	4,193,263	
3d. corn to the horses } employed in husbandry	2,995,184	
Deduct total home-consumption		11,980,748
Remains for market,		18,371,131

which is at the rate of 15.333 bushels from each acre.

It was before seen, that the quantity required by the whole nation for bread, was	11,615,378
Deduct what is required by the husbandmen as above.*	4,193,293
Remains for bread to the rest of the community	7,422,113

	Quarters.
From the quantity sent to market as before, viz:	18,371,131
Take the quantity as above required for bread,	7,422,113
Remains for the brewery, the distillery, starch, and corn for the horses not employed in husbandry	10,949,018

"Again, says he, suppose a year of scarcity, such as the crop of 1799, in which the return was at least $\frac{1}{4}$ less than a medium crop, hence the produce and disposal of it will be as under:

	Bushels.	Quarters.
4,646,150 acres of wheat, at	16,175 per acre	9,800,597
4,938,452 acres of barley and oats at	21,175 per acre	12,963,236
Total produce,		22,763,833
Deduct home-consumption as before		11,980,748
Remains for the market,		10,783,085

which is at the rate of 9 bushels the acre only.

Lastly, suppose a season of great fertility, such as the ever-memorable year 1779, when the crop was $\frac{1}{4}$ *above* a medium crop, and on which the farmers got all rich, although they sold their wheat at from 30s. to 40s. the quarter, and every thing else equally low. —The produce and expenditure of such a crop would be thus:

	Bush. per acre.	Quarters.
4,646,150 acres of wheat, &c. at	28,125.	16,334,121
4,938,452 do. barley and oats at	35.	21,605,727
Total produce,		37,939,848
Deduct home-consumption, as before,		11,980,
Remains for market,		25,959,100

which is at the rate of 21,666 per acre.

It is concluded that "although the precise quantities specified in the whole of this estimate may be considerably different from the real fact, yet the principle on which it is conducted will remain unshaken, particularly that which relates to the disposal of the crop, in which it is indispensible that a precise quantity (not a proportion) of the grain produced, be retained in the cultivators' own hands, without going to market at all; and this quantity, bearing a great proportion to the whole in a year of medium fertility, preponderates greatly against the market in a year of scarcity, and is only lightly felt in a season of abundance, in which the husbandman, having a vast proportion more of his crop to dispose of, not only can afford to sell it at a much less price, but actually gains more to himself. Other interesting calculations of this nature may be seen under the head arable-land. See *Arable-land.*

BREAK, a term applied to lands ploughed the first time after they have lain fallow in sheep-walks or otherwise.

* Under this description is included, not merely the farmers and their permanent labourers, but also the occasional work-people in hay-time, harvest, &c. A numerous body, and supported in these times on a very high rate of board.

BREAKING, in *rural economy*, signifies any thing that is turned or brought under subjection.

Breaking *of Horses*, the means of bringing them to bear a rider. - See *Horse*.

Breaking-*Up*, a term that is often applied to such lands as are ploughed from leys, or which is cut or pared for the purpose of being burned. See *Ploughing*, and *Paring* and *Burning*.

BREASTS, part of the bows of a saddle. See *Bows*.

Breast-*Plate*, the strap of leather that runs from one side of the saddle to the other, over the horse's breast, in order to keep the saddle tight, and hinder it from sliding backwards when the horse goes upon a rising-ground.

Breast-*Plough*, a small plough, contrived so that a man may shove it before him. It consists of a cutting-iron about eight or nine inches long, having one of its sides turned up to cut the turf. This iron is fixed to a pole bending upwards, about five or six feet long, and forked at the upper end, having a crutch, or cross handle, mortised into the forks. Against this crutch the ploughman places his breast, and shoves the plough forwards, in order to turn up the turf, its principal use being for cutting up the surface of the ground in the operation called burn-baking. See *Paring* and *Burning*.

BRECK, a provincial word applied to a breach or gap in a hedge. It is sometimes written *Brack*.

BREED, a sort or variety of any kind of live-stock. The breeds of most sorts of domestic animals are numerous, and distinguished by certain invariable marks, or appearances peculiar to each. In neat-cattle, sheep, horses, and hogs, there are a great number of different breeds, as may be seen under these different heads.

BREEDER, in *agriculture*, a farmer who is much employed in breeding and rearing animals of any of the domestic kinds.

BREEDING, in *rural economy*, the means of producing and rearing different sorts of domestic animals. It is a branch of the art of husbandry, to which great attention has lately been paid; but which probably depends on principles and circumstances that are not yet fully investigated or understood. Much improvement has, however, been effected in the raising of almost every kind of live-stock, since the nature and means of its support have been better known, and more abundantly provided. It is probable that the greatly increased demand for the animals, either in consequence of their usefulness for the purposes of labour, or those of supplying the food of mankind, has had much effect in promoting this sort of improvement, as rendering it more an object to the breeder, as well as grazier. The author of Practical Agriculture, has remarked, that notwithstanding much has been done in different districts, in bringing different breeds of different sorts of live-stock to a greater state of perfection, much still remains to be effected; and that it is probably far from having reached that point to which it is capable of being carried, by the judicious combination of the best and most appropriate breeds of domestic animals, with the improvements in the cultivation of herbage, or other sorts of green food for their support. To fully explain the means of accomplishing such improvements in every sort of stock, many additional facts and experiments are, however, probably necessary. All that can be done at present is, perhaps, that of presenting the farmer with a few hints and directions, which may serve as guides in conducting the business.

But in pursuing attempts of this nature to any extent, it has been well suggested by Mr. Middleton, that "great care should be previously taken, that there be a sufficient degree of shelter, shade, and warmth; and at the same time a high state of fertility in the land, with suitable drainage; as it is only by the richness and abundance of food that such changes, or improvements, can be made in the most advantageous manner, or the stock be carried to any high state of perfection."

Mr. Cline has well observed, that "the external form of domestic animals has been much studied, and the proportions are, he thinks, well ascertained. But the external form is an indication only, he conceives, of internal structure. The principles of improving it must therefore be founded on a knowledge of the structure and use of the internal parts.

"*The Lungs.* These are of the first importance. It is on their size and soundness that the strength and health of an animal principally depends. The power of converting food into nourishment, is in proportion to their size. An animal with large lungs is capable of converting a given quantity of food into more nourishment than one with smaller lungs; and, therefore, has a greater aptitude to fatten.

"*The Chest.* The external indications of the size of the lungs, are the form and size of the chest; the form of which should approach to the figure of a cone, having its apex situated between the shoulders and its base towards the loins. The capacity of the chest depends on its form more than on the extent of its circumference; for, where the girth is equal in two animals, one may have much larger lungs than the other. A circle contains more than an ellipsis of equal circumference; and, in proportion, as the ellipsis deviates from the circle, it contains less. A deep chest, therefore, is not capacious; unless it is proportionally broad.

"*The Pelvis* is the cavity formed by the junction of the haunch-bones, with the bone of the rump. It is essential that this cavity should be large in the female, that she may be enabled to bring forth her young with less difficulty. When this cavity is small, the life of the mother, and her offspring, is endangered. The size of the pelvis is chiefly indicated by the width of the hips, and the breadth of the twist, which is, the space between the thighs.

"The breadth of the loins is always in proportion to that of the chest and pelvis.

"*The Head* should be small, by which the birth is facilitated. Its smallness affords other advantages,

and generally indicates that the animal is of a good breed. Horns are, he says, useless to domestic animals, and they are often a cause of accidents. It is not difficult to breed animals without them. The breeders of horned cattle, and horned sheep, sustain a loss more extensive than they may conceive; for, it is not the horns alone, but also much more bone in the skulls of such animals to support their horns, for which the butcher pays nothing; and, besides this, there is an additional quantity of ligament and muscle in the neck, which is of small value. The skull of a ram with its horns, weighed five times more than another skull which was hornless. Both these skulls were taken from sheep of the same age, each being four years old. The great difference in weight, depended chiefly on the horns: for the lower jaws were nearly equal, one weighing seven ounces, and the other six ounces and three quarters; which proves that the natural size of the head was nearly the same in both, independent of the horns and the thickness of bone which supports them. In a horned animal, the skull is extremely thick. In a hornless animal, it is much thinner; especially in that part where the horns usually grow. To those who have not reflected on the subject, it may, he observes, appear of little consequence whether sheep and cattle have horns; but, on a very moderate calculation, it would be found, that the loss in farming-stock, and also in the diminution of animal food, is very considerable, from the production of horns and their appendages. A mode of breeding which would prevent the production of these, would afford a considerable profit in an increase of meat, and wool, and other valuable parts. The length of the neck should be proportioned to the height of the animal, that it may collect its food with ease.

" *The Muscles*, and *tendons*, which are their appendages, should, he conceives, be large; by which an animal is enabled to travel with greater facility.

" *The Bones.* The strength of an animal does not depend on the size of the bones, but on that of the muscles. Many animals with large bones are weak, their muscles being small. Animals that were imperfectly nourished during growth, have their bones disproportionately large. If such deficiency of nourishment originated from a constitutional defect, which is the most frequent cause, they remain weak during life. Large bones, therefore, generally indicate an imperfection in the organs of nutrition."

Very different modes of practice have been followed in the improving of live-stock; but the principal are those of crossing the different breeds, so as to supply the imperfections and defects of the one, by the merits and perfections of the other; and of uniting the valuable qualities or perfections of the same kinds, by selecting and continuing to breed from the most perfect animals in the same line or family. The former of these methods has been long known and employed; but the latter has only within these few years, been fully introduced to the notice of the farmer, and is not, probably, yet so much attended to as it would seem to deserve. It has been commonly supposed, that the practice of crossing the breeds of domestic animals possesses various other advantages, as well as those of preventing the decrease and degeneracy of the stock, on account of the animals being kept from becoming too nearly related to each other. There are many facts, however, which shew that the supposition of the degeneracy of animals, in consequence of the nearness of their relationship, is not so well founded as has been commonly imagined. The complete success of the contrary practice in the management of Mr. Bakewell, who reared his best stock by the nearest affinities, not only without degeneracy in any respect whatever; but with a continued improvement and amelioration, makes strongly against the opinion, as well as the circumstance of cattle in the wild state, in particular situations, remaining for centuries without the least alteration taking place in their form, or change in their colours, or other properties. It has, notwithstanding, been asserted, that in this system of breeding, young stock decrease rapidly in size. If, however, such a circumstance was really apt to occur, it could hardly have been overlooked, or disregarded by the very expert and intelligent breeder just mentioned, in his long and very extensive experience of raising various kinds of live-stock, by coupling the most perfect animals of the same line or family.

There cannot be any doubt, however, but that by the method of crossing the breeds of animals, much advantage may be derived, especially in what relates to size, and some other properties noticed below; yet it is obvious, that it must require the nicest care, and the greatest circumspection, in order to suit the animals in the most exact manner to the nature of the improvement that is intended, otherwise injury, instead of advantage, may be the consequence. Indeed, from the injudicious and random method in which improvements of live-stock, on this principle, have, in general, been undertaken, it does not seem improbable, but that injury may often have been produced instead of benefit, by uniting such breeds, as from the great dissimilarity of their sizes, forms, qualities, or other properties, could not have any chance of effecting the purpose with utility. Besides, in almost every district in the kingdom, where the breeding system is pursued to much extent, useful breeds of domestic animals are asserted to have been injured by the practice of injudicious crossing, as may be seen by the various reports that have been published by the Board of Agriculture. And Lord Somerville, in his excellent view of the System of the Board of Agriculture, has very pertinently remarked, " that to the mountebank doctrine of crossing dissimilar breeds, whom nature in its infinite wisdom had set asunder, we are indebted for much confusion and mismanagement." It cannot, however, be disputed, but that by pursuing this method with judgment, and proper attention, great advantages may often be obtained, especially in regard to bone or size, and the hide or coat, as well as in the improvement of particular parts or *points*; and pro-

bably in what relates to the movement, or speed of the animals.

In a paper inserted in the fourth volume of Communications to the Board of Agriculture, Mr. Cline has ingeniously endeavoured "to ascertain in what instances crossing is proper, and in what prejudicial; and the principles upon which the propriety of it depends. It has, he observes, been generally supposed that the breed of animals is improved by the largest males. This opinion has, in his opinion, done considerable mischief, and would have done more injury if it had not been counteracted by the desire of selecting animals of the best form and proportions, which are rarely to be met with in those of the largest size. Experience has proved, he thinks, that crossing has only succeeded, in an eminent degree, in these instances in which the females were larger than in the usual proportion of females to males; and that it has generally failed when the males were disproportionally large."

With regard to the improvement of form on these principles, it has been observed, that "when a particular variety approaches perfection in form, breeding *in-and-in* may be the better practice; especially for those who are not well acquainted with the principles on which improvement depends. When the male is much larger than the female, the offspring is generally of an imperfect form. If the female be proportionally larger than the male, the offspring is of an improved form. For instance, if a well-formed large ram be put to ewes proportionally smaller, the lambs will not be so well shaped as their parents: but, if a small ram be put to larger ewes, the lambs will be of an improved form. The proper method of improving the form of animals, consists, he supposes, in selecting a well formed female, proportionally larger than the male. The improvement depends on this principle, that the power of the female to supply her offspring with nourishment is in proportion to her size, and to the power of nourishing herself from the excellence of her constitution. The size of the fœtus is generally, he asserts, in proportion to that of the male parent; and, therefore, when the female parent is disproportionately small, the quantity of nourishment is deficient, and her offspring has all the disproportions of a starveling. But when the female, from her size and good constitution, is more than adequate to the nourishment of a fœtus of a smaller male than herself, the growth must be proportionately greater. The larger female has also a greater quantity of milk, and her offspring is more abundantly supplied with nourishment after birth. To produce the most perfect formed animal, abundant nourishment is necessary from the earliest period of its existence, until its growth is complete." And, "it has been observed, that the power to prepare the greatest quantity of nourishment from a given quantity of food, depends principally on the magnitude of the lungs, to which the organs of digestion are subservient. To obtain animals with large lungs, crossing is the most expeditious method; because well formed females may be selected from a variety of a large size, to be put to a well formed male of a variety that is rather smaller. By such a method of crossing, the lungs and heart become proportionately larger, in consequence of a peculiarity in the circulation of the fœtus, which causes a larger proportion of the blood, under such circumstances, to be distributed to the lungs than to the other parts of the body: and, as the shape and size of the chest depend upon that of the lungs, hence arises the remarkably large chest, which is produced, by crossing with females that are larger than the males. The practice, according to this principle of improvement, however, ought, he thinks, to be limited; for it may be carried to such an extent, that the bulk of the body might be so disproportioned to the size of the limbs as to prevent the animal from moving with sufficient facility. In animals, where activity is required, this practice should not be extended so far as in those which are intended for the food of man."

It should not of course be carried so far in breeding cattle for the purposes of labour, or in that of horses for the field, or the lighter sorts of carriages, as in those for other purposes.

The Character of Animals. "By character in animals is here meant, Mr. Cline says, those external appearances by which the varieties of the same species are distinguished. The characters of both parents are observed in their offspring; but that of the male more frequently predominates. This may be illustrated in the breeding of horned animals; among which, there are many varieties of sheep, and some of cattle, that are hornless. If a hornless ram be put to horned ewes, almost all the lambs will be hornless; partaking of the character of the male more than of the female parent. In some counties, as Norfolk, Wiltshire, and Dorsetshire, most of the sheep have horns. In Norfolk, the horns may, he supposes, be got rid of, by crossing with Ryland rams; which would also improve the form of the chest, and the quality of wool. In Wiltshire and Dorsetshire, the same improvements might be made by crossing the sheep with South Down rams. An offspring without horns might, he conceives, be obtained from the Devonshire cattle, by crossing with hornless bulls of the Galloway breed; which would also improve the form of the chest; in which, the Devonshire cattle are often deficient.

"Examples are, he says, to be met with of the good effects of crossing the breed, in the great improvement of the breed of horses, which took place in this country, from the practice of crossing with those diminutive stallions Barbs and Arabians; and the introduction of Flanders mares into this island, was, he thinks, the source of improvement in the breed of cart-horses.

"The form of the swine has also, in his opinion, been greatly improved, by crossing with the small Chinese boar."

And examples of the bad effects of crossing the breed, are found in the practice, which was common, "when it became the fashion in London to drive large bay horses, of the farmers in Yorkshire putting their mares to much larger stallions than usual, and thus causing infinite mischief to their breed, by producing

a race of small chested, long legged, large boned, worthless animals. A similar project was, he remarks, adopted in Normandy, to enlarge the breed of horses there, by the use of stallions from Holstein; and, in consequence, the best breed of horses in France would have been spoiled, had not the farmers discovered their mistake in time, by observing the offspring much inferior in form to that of the native stallions." And, "some graziers in the Isle of Sheppey, conceived, he says, that they could improve their sheep by large Lincolnshire rams, the produce of which, however, was much inferior in the shape of the carcase, and the quality of the wool; and their flocks were greatly injured by this attempt to improve them. Attempts to improve the native animals of a country, by any plan of crossing, should, he observes, be made with the greatest caution; for, by a mistaken practice, extensively pursued, irreparable mischief may be done. In any country, where a particular race of animals has continued for centuries, it may be presumed that, their constitution is adapted to the food and climate. The pliancy of the animal economy is such, as that an animal will gradually accommodate itself to great vicissitudes in climate, and alterations in food; and, by degrees, undergo great changes in constitution; but these changes can be effected only by degrees, and may often require a great number of successive generations for their accomplishment. It may be proper to improve the form of a native race, but at the same time it may be very injudicious to attempt to enlarge their size."

"The size of animals is, he thinks, commonly adapted to the soil which they inhabit. Where the produce is nutritive and abundant, the animals are large, having grown proportionally to the quantity of food which, for generations, they have been accustomed to obtain. Where the produce is scanty, the animals are small, being proportioned to the quantity of food which they were able to procure. Of these contrasts, the sheep of Lincolnshire, and of Wales, are examples. The sheep of Lincolnshire would starve on the mountains of Wales."

It is conceived, that "crossing the breed of animals may be attended with bad effects in various ways; and that even, when adopted in the beginning, on a good principle; for instance, suppose some larger ewes than those of the native breed, were taken to the mountains of Wales, and put to the rams of that country; if these foreign ewes were fed in proportion to their size, their lambs would be of an improved form, and larger in size than the native animals; but the males, produced by this cross, though of a good form, would be disproportionate in size to the native ewes; and, therefore, if permitted to mix with them, would be productive of a starveling, ill-formed progeny. Thus a cross which, at first, was an improvement, would, by giving occasion to a contrary cross, ultimately prejudice the breed. The general mistake in crossing has arisen, he thinks, from an attempt to increase the size of a native race of animals; being a fruitless effort to counteract the laws of nature."

It is also observed that "the Arabian horses are, in general, the most perfect in the world; which probably has arisen from great care in selection, and also from being unmixed with any variety of the same species; the males therefore have never, he supposes, been disproportioned in size to the females.

"The native horses of India are small, but well proportioned, and good of their kind. With the intention of increasing their size, the India Company have adopted a plan of sending large stallions to India. If these stallions should be extensively used, a disproportioned race must be the result, and a valuable breed of horses may be irretrievably spoiled." In short, "from theory, from practice, and from extensive observation, which is, he says, more to be depended on than either, it is reasonable to form this conclusion, that it is wrong to enlarge a native breed of animals, for in proportion to their increase of size, they become worse in form, less hardy, and more liable to disease."

The author of the practical work mentioned above, has farther remarked, that as it is in some measure a principle founded in physiological science, and countenanced by the observation and experience of ages, that animals are somewhat endowed with the faculty of not only propagating an offspring, that has, in a considerable degree, the properties, dispositions, and resemblance of themselves, but that is in some measure subject to a similarity of disease; it would appear, that although there may be occasional deviations, the most certain method, and that which has the best foundation in the nature and economy of an animal, in so far as the particular qualities and other properties, besides those that have been first mentioned, are concerned, is to breed in the same line, and perhaps in the same family; as by a careful procedure in this way, the expert breeder may not only have the greatest security for attaining that improvement which he is anxious to produce, but run the least risk of deterioration. The success of this practice, it is contended, has not merely been shewn in the breeding of the farmer's stock, but also in that of the sportsman; as it has been found that pointers and game cocks have been bred with the greatest perfection and superiority in this mode, and that it is by the same means that the valuable properties of the race-horse are perpetuated and preserved; the same thing likewise, it is added, takes place in the vegetable economy, the finest and most perfect productions of this sort being propagated by sowing seed selected from the best and most perfect plants of the same kind, and taking the buds or offsets from the best and most perfect trees of the same species. There is also another circumstance, the same author thinks, that seems to shew the propriety and superior advantage of this method of proceeding in the breeding of domestic animals, which is, that however much the breeds of live-stock may be altered by climate, pasture, and other causes, in what respects their colour and other trifling particulars, their specific characters are still invariably the same. No causes of these kinds have ever been capable of changing any one of the distinct breeds, whether of neat-cattle, sheep, horses, or hogs, in such a manner

as to have the characteristic distinctions of those of any of the others. On these principles it is therefore concluded, that by having recourse to occasional crossing in the above intentions, and the careful selection of the most perfect animals of the same breed or kind, with due attention to constant good feeding, the improvement of live-stock may be carried to the greatest perfection. It may be observed still further, "that as the principal object of the breeding farmer must constantly be that of obtaining such animals as will afford him the largest profit, it may be necessary to ascertain the nature and form of the animal that may be most advantageous in this view; or which pays the best for the food that is consumed, as by this means it will be seen what points are the most desirable or useful in a breed or variety, and what circumstances ought to be attended to, so as to justify its introduction in preference to any other."

The properties which seem the most particularly to interest the breeder in his attempts to improve the different sorts of live-stock, have principally been considered those of *form* or *shape*, *size*, *disposition*, *hardiness*, *quick maturity*, *nature of flesh*, *fattening property*, *milk*, *hide*, *aptitude for labour*, and the *quality* of the breed, or, in the language of the art, *blood*.

In respect to *form*, "the notions of breeders have been considerably at variance; but it would seem that there can only be one perfect form, which must be that which approaches the nearest to exactness in the shape and proportion of the different parts. Whenever this is met with, it indicates the true form, and is that which ought to be aimed at by the breeder, whatever the nature or breed of the animal may be. It is therefore conceived, that in this view a perfectly formed animal should have an exact proportion and consistency in all the different parts; the head neat and compactly formed, but neither too large or of too great a length; the eyes bright and prominent; the neck not of too great length, but somewhat thin, gradually narrowing from the breast towards the head, to which it should be neatly attached; the chest round, wide, full, and of deep girth; the length of the legs well proportioned to the size; the fore ones straight and clean, the hind ones forming an angle at the hock, so as to stand well under the loins; the distance between the feet in the different extremities equal; the feet round and even, the hoofs straight; the back and loins straight and broad; the belly firm and capacious; the quarters deep, full, and well-fleshed downwards." But though extremely difficult to convey any very correct idea of the shape of animals by words, it would seem that, that which comes up in some measure to this standard, must constitute that "*utility of form*" which has been the great object of modern breeders. "And it is probable that such a form is the best calculated for the chief object of the farmer, which is that of receiving and supporting flesh in the practice of fattening; as, where animals much exceed or fall short of such correct proportions of parts, there must be inconvenience or disadvantage, either in their being weak and less disposed to fatten,—of course requiring more food, and a greater length of time for accomplishing the business,—or in their being deficient in the general weight and value of the meat, from their not fattening sufficiently on the best parts." It has been observed by Mr. Young, to have been the constant principle of that most intelligent breeder Mr. Bakewell, to procure such animals, whether of the cattle or sheep kind, as were capable of weighing the "most in the most valuable joints," as there is a great difference, he says, between an ox of fifty stone, carrying thirty in roasting pieces, and twenty in coarse boiling ones,—and another carrying thirty in the latter, and twenty in the former. Sir John Sinclair also remarks, that "it must undoubtedly be an object of great importance, to have those parts which are of but little value, as small and of as little weight as possible. It may also be advantageous in particular cases, to attend to the nature of the consumption in the shape of the animals, in the manner that has been just stated; as, where some parts are more in demand than others, and consequently sell at much higher prices, that shape which is most favourable for this purpose should be more attended to."

It is observed as probable, however, "that it is on the just proportion and symmetry of parts in the animals that are employed for the purpose of the breeder, that improvement in this as well as other important points must depend. And of course that it seems not improbable, but that the excellence of the most valuable points in all the different sorts of stock may, in some degree, bear a proportion to the goodness of the form in the animals." And it is added, that "that fine fullness of shape which has been distinguished by breeders under the term *beauty of form*, has been considered as distinct from that of *utility of form*, and to consist in a more perfect rounding of the parts, and a less appearance of boney protuberance. But though it must constantly be a very desirable object to bring the shape of the animals as near perfection as the difficult nature of the business will admit, yet utility, or what may in other words be termed profit, must be principally considered, as being the immediate object of the stock-farmer and grazier."

It has been well remarked, that "in the size of animals there is a variety, which admirably adapts them to the variations of soil, climate, situation, and food, as well as the different views and purposes of the farmer." It is stated, in a late practical work, that "the long agitated question, whether large or small-sized animals are the most profitable, or pay the grazing farmer the most money for the food they consume, is not yet fully decided; nor is it probably capable of being easily ascertained, on account of the great difficulty of making experiments under an exact similarity of circumstances, in regard to breed, pasture, food, exposure, and other points; and what is the difference in the growth, or increase of weight, or of labour, between large and small animals, in proportion to the quantity of food which they take for their support. And lastly, what is the difference in the increase and quickness of feeding, in stock of different sizes, in relation to the quantity of food which

they consume. A varied set of experiments, correctly made with a view to these different points, would no doubt, he thinks, lead to many useful conclusions, though they would not, probably, finally settle the dispute, on account of the great difficulties that must always attend such comparative investigations, from the variation of circumstances, and other causes. It would seem, therefore, he says, that, in the present state of our knowledge, no certain directions can be given, in respect to the size of cattle, that will be generally applicable in governing the conduct of the grazier. The largeness of size, though it is a property that may be desirable, in so far as it affords the means of feeding to a great weight; yet, as this is probably acquired by a much larger and longer continued consumption of food, it is probable that, except in situations where food is abundant, the smaller-sized animals may be the more profitable. In deciding the point, it is not, he observes, merely, as has been seen, the difference in the quantity of flesh that they are separately capable of affording, but the difference of such quantity in relation to the consumption of food, that is to be considered. It was found by Mr. Bakewell, that the "smaller the bone, the truer the make of the beast," and the quicker in fattening; which throws the advantage on the side of small size: and the experience of graziers in general seems to favour the same conclusion, as they commonly find that the middling and small breed are the most profitable, from their fattening with the greatest expedition." And it has been well remarked by Mr. Young, that the Lincolnshire and Holdernesse breeds of cattle "are very large, but their size lies in their bones; they may be fattened to great loss to the grazier," but can never "return so much for a given quantity of grass as the small-boned, long-horned kind."

But it may perhaps be objected by some, that the difference in the consumption of food between the large and small-sized animals is not so considerable as is commonly supposed. However, "though it must be allowed that considerable latitude may take place in this respect, according to the state of the digestive organs and other causes, long experience among graziers has shown in the most decisive manner, that a number of small-sized stock consume much less food in a given time than large, as in some cases they can stock nearly in the proportion of two to one. Mr. Knight, however, in a paper in the second volume of Communications to the Board of Agriculture, inclines to the side of large cattle being the most profitable, from their not consuming food in the proportion of their weight; as, on putting the question of the difference in the weight of food consumed by the largest and smallest in a given time, to different breeders in different parts of the district where he resides, he found that they agreed, "that the same quantity of food was given to the smallest and the largest beast of the same age; that the largest, even when not master of the same fold, often kept itself in the best condition; and that every thing depended on the disposition to fatten, and very little on the size of the animal." In his own stock, he also asserts the same thing to be precisely the case. It is however admitted, as just stated, that a certain quantity of large cattle will mostly consume more than the same quantity of small ones; but not by any means in proportion to their weight." These statements are, however, only the result of observation, without being supported by actual experiment, and the uncertainty of conclusions made in this way, are well known.

The author of a late System of Agriculture remarks that "with regard to any difference that may take place in the quality of the meat from the difference of size, it would seem to be in favour of the smaller breeds; as the fineness of the muscular fibre, or what has been commonly termed the grain of flesh, has been found to be the most delicate in the smaller breeds of animals. It is on this account, as well as that of convenience, that the mutton, beef, and other sorts of meat of small animals are so constantly preferred by the nice palates of those who indulge in the pleasures of the table." And that "in opposition to the idea that small animals, when fatted, are in common worth more for any given weight of meat than large ones; it is, he says, contended, by Mr. Knight, that if the animal be taken as it stands in the pasture or stall, the contrary is the truth: but that, when the butcher merely buys what are termed the valuable parts, and receives the offal into the bargain, he will, unquestionably, for obvious reasons, "give more for two cows of twelve stone each a quarter, than for one of twenty-four." The offal is of much greater value, besides a considerable advantage in the hides. In short, he says, it is concluded by him, that "the difference between the weight of the animals when living, and of the four quarters when dead, is always in an *inverse* proportion to their size when their forms and merits are equal; but the bones will *then* be in proportion to the *living weight*, and therefore small animals must be in this case *most disadvantageous to the consumer*."

The former writer however conceives, that "from the greater size of the muscular parts in large animals, the flesh would seem to be more coarse in the very large breeds, and of course be less valuable, than in those of the small." He says, that "it is also supposed an advantage by Mr. Knight, in the large animals, that the meat when preserved for future use is not only better, from the juices being more fully retained, but from their being less waste, on account of the external surface being proportionately less. And that it is observed, in regard to the opinion that animals of the smaller kinds are in general more hardy than those of the large breeds, that if it be meant merely that they are capable of subsisting on shorter herbage, it is right, as a large animal, though it may have exactly the same form as the small one, necessarily requires more time for rest. It feeds and removes itself with greater labour; and notwithstanding it may be as strong again, as having double the weight, it will still in relation to itself be a weaker animal. Its head and neck will be as heavy again, and from their greater length, the weight will recede further from the centre of motion in the shoulder; consequently increase in power in proportion

to the distance: and the same thing holds good in respect to the whole of the limbs. In the stall, or the fold, where large oxen are mostly fed, these disadvantages are, he conceives, of no consequence, as the food is received without the trouble of looking for it; and if the necessity of a better pasture does not proceed from the larger animal consuming much more, but from less power in collecting food, the consequence will be, that it must "afford the largest weight of flesh with the smallest consumption of grass." And on the point of small-sized animals having been asserted to be less prejudicial in poaching the ground than large ones, on account of their feet being wider in proportion to the weight. It is conceived by Mr. Knight, that "the question is, whether the feet and mouths of two small animals will not injure the herbage more than that of one large one?" It is remarked, that small sheep do not poach the ground at all; yet it is supposed that "a score of these weighing a ton in the aggregate will do more injury to a rich pasture in forty-eight hours than an ox of the same weight in a week. Cows and oxen should, it is said, be kept in the stall and the fold when the ground is wet during the winter, and capable of being injured by poaching; and in the summer it is not injured by the heaviest stock." It is allowed, however, that "in cases where the weight of meat is of no material consequence, as in dairy-cattle, the advantage may be on the side of small animals, as such cows will give nearly the same quantity of milk separately as those of the large kind; and are capable of subsisting on shorter herbage, and without injuring the ground in the same degree; but where the weight and value of the meat form the principal considerations, the largest animals the pastures are calculated to support, are supposed to be the most beneficial to the breeder and the public."

It is, however, stated by Sir John Sinclair, that "in the smaller-sized animals, there are advantages in their being capable of being fattened wholly with grass, without having recourse to the more expensive kinds of food, which must be the case with those of a large kind, and on pastures of inferior qualities; in their being procured with less difficulty, and more adapted to particular situations and circumstances of farmers; and from their being less loss in case of accidents taking place, which is frequently the case."

The author of Practical Agriculture, from these different statements, concludes, "that as there appear some things favourable to each side, the attention of the breeder should be principally directed by the nature and circumstances of his pastures, as well as the command of other sorts of food which he possesses; the middle and smaller breeds of live-stock being preferred on the less rich and inferior kinds, and the large sorts in such situations as are more rich and fertile, and wherever there is a sufficient command of food."

And with regard to the disposition of animals "it is, without doubt, he thinks, a matter of much utility and importance to have such breeds of domestic animals as are possessed of tame and gentle dispositions, without being too dull or sluggish in their habits, as such animals are not only less disposed to ramble and break the pastures, but are capable of being reared, fed, and rendered fat, with considerably less food. In the production of this sort of disposition much, he supposes, depends upon the modes of rearing the animals. Mr. Bakewell had all his animals, even his bulls, so tame and gentle, from early care in this respect, that they could be managed with the greatest ease and facility" by any person. And all animals may be rendered tame and gentle, by care in giving them such habits while they are young.

It cannot be doubted but that "hardiness of constitution is a property in live-stock that much deserves the attention of the breeder, as upon this much advantage to the farmer must, in many instances, depend. In exposed situations, it is an essential and indispensable property; and under all circumstances, it must be beneficial to the farmer that a breed is not liable to disease. Besides, hardy animals always thrive much better, than such as are more tender and delicate in their nature. The circumstances which have been commonly supposed to denote this disposition are, according to the above author, those of darkness of colour and roughness of hair. Animals of other colours are however frequently not deficient in this property: and it does not seem to depend much upon the colour, but perhaps on the breed, and the manner in which the animal has been reared." The nature of the animal is unquestionably concerned in this property.

In respect to "another property, which is of great consequence to the breeder, as much of his profits must always depend in a great degree upon it, and which is that of quickness in arriving at the state of maturity, Sir John Sinclair has remarked, that with this the abundance of supply is likewise, in a great measure, connected: of course it is a property that greatly interests the public as well as the farmer, and on both accounts deserves the particular attention of the breeder. It is probable that some sorts of stock, from their labour, or the produce which they afford, may be kept longer with profit by the farmer than others. This has been supposed to be the case with neat-cattle, though not with sheep; but the distinction is, perhaps, not well founded, as the latter obviously afford a return in various ways." And that "it is evident that the manner in which animals are fed must have much influence in this respect; as when, from the constant full supplies of food, they are always kept in a thriving condition, they will of course arrive much earlier at the state of maturity than under the contrary circumstances. This will be the case, whatever the nature of the stock may be. It has been asserted that, under this mode, a greater progress is made in three years than in the ordinary pinching method of rearing is effected in five. The necessity of not suffering animals to be checked or stunted in their early growth, by the want of proper care, food, and warmth, is thus fully demonstrated, and of course it is a point that should never be lost sight of by the attentive breeder in the raising of different sorts of live-stock.

It is observed by the author quoted above, that

it is scarcely necessary, after the observations that have been made, to say any thing farther in respect to "the nature or quality of the flesh of animals, as it would seem to be a property inherent in the muscular substance, and probably depending in a great measure, if not wholly, on the breed. It is indeed observed, he says, by Mr. Marshall, in speaking of the breeding of animals in the midland districts, where the *flesh* is "spoken of with the same familiarity as the hide or the fleece," that the grain is clearly understood to depend wholly on the breed, and not, as has been heretofore considered, on the size of the animal." And, that "the difference in the flavour of the flesh of different breeds or varieties of animals would seem to depend in a great degree on the nature of the food: while that of colour is probably in a great measure fixed and inherent, and the effect of breed: experiments are, however, he conceives, wanting on these points, in order to place them in a more clear light. The supposition of its having a relation to that of the colour of the skin, is probably without any just foundation. Wherever any very material deviation from the natural colour of flesh is met with in meat, as has sometimes been the case, it is, he thinks, probably the effect of a morbid condition of the animal. In the living state, the proofs of good flesh are, he says, a mellow, elastic, rather firm, feel, without any degree of harshness; and in the dead condition a similarity of feel, with a fine grain and marbly appearance. The difference of age and sex may likewise, he conceives, afford some variety in respect to the quality of the flesh, as in old animals it must be more firm, and less tender and juicy, than in those that are young, as is found by experience. And the fineness of the grain is mostly found much greater in animals of the female than the male kind. Some of the more northern breeds of Scotch cattle are said to excel much in the quality of their flesh, when killed at a proper age, and well fattened."

A further property, in some degree connected with that just mentioned, that of the disposition to fatten while young, in an expeditious manner, when fully fed, is one on which the profit of the grazier must in a high degree depend, as, where it does not prevail, much of his food must be uselessly expended. "It cannot therefore, in the opinion of the above writer, in this view, be too much regarded in the selecting of his stock. The circumstances on which it depends have not, perhaps, yet, he says, been fully investigated; but it is well known that some animals become fat with a very small consumption of food, while others that eat much larger proportions always remain in a lean state. So far as observation has yet gone, this is, he thinks, a property that would seem to be in some measure connected with smallness of bone." Sir John Sinclair seems to think it "probable, however, that a tendency to fatten arises from some particular circumstance in the internal structure of the body, of which small bones are in general an indication; and that it is only in this point of view that they ought to be considered essential; for they often weigh as heavy, and consequently require as much nourishment, as large ones;—small bones, like those of the blood-horse, being compact and heavy; large bones, like those of the common dray, or cart-horse, being extremely porous, and consequently light for their apparent bulk. Indeed, cattle ought not only, he supposes, to be easily maintained in point of quantity, but, in remote and uncultivated districts, in regard to the quality also of the food they consume; and it is certain that some particular animals will fatten as well on coarse fare, as others will do on the most luxuriant." The practice of Mr. Bakewell, as well as that of many other breeders, would seem to demonstrate that it depends greatly on the form and breed of the animals, of whatever sort they may be.

And it is stated, that "some have affected to think less favourably of the utility of this property or disposition, on account of the largeness of the proportion of fat that is sometimes produced, which is conceived by no means so useful or economical, in the consumption as food, as that of the lean part. But where a superabundance or excess of fat takes place, it would seem to be in a great measure the fault of the grazier, and not of the nature or disposition of the breed."

It is said to have been suggested by Sir John Sinclair, "that the disputes in respect to the utility or inutility of fattening animals to the great degree that has been lately the custom, must of necessity proceed from the want of sufficient discrimination; as fat meat, though not so fit for common use, is in general considered as affording more nourishment than lean, when the state and vigour of the stomach are suitable for digesting it; and that although there may, in the common methods of cooking it, be some loss, by proper care and attention, there are ways in which this may be almost wholly avoided." Thus, he remarks, that "the keelmen of Newcastle purchase great quantities of fat meat, as they follow the custom, so usual in Scotland, of boiling their meat; the broth of which feeds their family, whilst they themselves eat the meat, generally in a cold state, and in great quantities; and are thus enabled to go through the heavy labour they usually undergo. In many districts, manufacturers and others bake their meat with potatoes under it; and the fat, melted by the fire, falls upon the potatoes, and improves much their taste, and the nourishment to be derived from them. In either of these ways, little, if any, of the substance of the meat is, he thinks, lost." And, Dr. Dickson conceives, that "such suppositions are probably futile on other principles, as there does not appear to have yet been any other discovery made for increasing the quantity of muscular substance, or lean flesh, than that of cultivating the fattening property of animals. It has long, he says, been an observation among breeders and graziers, that "good fat makes good lean." The importance of this propensity is therefore, he thinks, considerable, and requires the particular notice of the modern breeder in the raising of his live-stock."

There is still, he says, "another property that ought to be regarded in the breed of animals, as it in some measure furnishes the means of determining the disposition to fatten, by the feel which it affords. This is the state of the hide or skin. It is remarked, he observes, by Sir John Sinclair, that "when it feels soft and silky, it strongly indicates a tendency in the animal to take on meat; and it is evident that a fine and soft skin must be more pliable, and more easily stretched out to receive any extraordinary quantity of flesh, than a thick or tough one. At the same time, thick hides are of great importance in various manufactures. They are indeed necessary in cold countries, where cattle are much exposed to the inclemency of the seasons; and, in the best breeds of Highland cattle, the skin is, he observes, thick in proportion to their size, without being so tough as to be prejudicial to their capacity of fattening."

And the property of supplying in large proportions an useful product, such as that of milk, is an object that should not be lost sight of by the breeding farmer. The question of the propriety of having a distinct breed exclusively for this purpose, or that of having it only partly calculated for this use, and partly for that of the butcher, has not yet, Sir John Sinclair observes, been fully decided: but as it has been found by long experience, that such cows as have much propensity to fatten, seldom answer the purpose of the dairy, it would seem that there ought to be a breed particularly for the pail. It has, however, been suggested by him as probable, that "by great attention, a breed might be reared, the males of which might, in every respect, be well calculated for the shambles, and the females, when young, produce abundant quantities of good milk, yet, when they reached eight or nine years of age, be easily fattened. Such a breed would, he supposes, be of the greatest value of any that could be produced. Some of the best English and Scotch breeds have, he believes, nearly attained this point of perfection."

And the fitness of animals for the purpose of labour, is a quality that, in certain circumstances, may be necessary to be considered in the breeding of cattle-stock. The question of the advantage that may be gained in this practice, in regard to the increase in the quantity of meat, is, Dr. Dickson observes, far from having been decided; nor has it been well explained whether injury may not be done in restricting the growth of the animals by this means, more than can be compensated by their labour. It is obvious, however, he thinks, that where cattle are worked, they must be longer in being brought to the market. But as, from the greater cheapness of rearing and keeping neat-cattle than horses, and various other causes, it may be necessary to make use of cattle for the purpose of labour, a breed well calculated in this respect must be desirable in different situations.

The last property which it may be necessary for the breeder to particularly consider in the improvement of his stock, is that of *blood*, adopted in analogy to the system of breeding in the race-horse. This is employed to signify the natural, fixed, and inherent properties of a breed or kind, as exemplified in their external appearances. Its utility for the purposes of the breeder is, therefore, to enable him to discriminate, with greater nicety and correctness, in the selection of such animals as are the most adapted to the improvements he has in contemplation, whatever the sort or breed of the animal may be.

The above writer concludes by observing, that "these are the main objects to which the breeder should attend, and the means by which he is principally to effect his improvements. The success of his endeavours, to whatever species of excellence his attention may be directed, must obviously, he says, in a great measure depend upon the accuracy and correctness of his judgment in choosing those breeds, of whatever sort of live-stock they may be, that are most adapted to his circumstances; and in selecting such individuals, both male and female, of such breeds, as are the most perfect and exact in their different parts and properties; cautiously continuing to breed from them, without ever suffering the least intermixture by the admission of those of inferior qualities; advancing in this way with the nicest attention to such faults or defects, however trifling, as may arise, so as to alter and correct them by appropriate pairing in the succeeding generations. And as an indispensable assistant in this arduous undertaking, he must constantly have recourse to the aid of good and abundant keep at all seasons, with suitable degrees of shelter and warmth for both the old and young stock; so that they may never decline in flesh, or be checked in their growth. This would, he thinks, seem to constitute the great secret of the important art of breeding live-stock, which the superior discernment and unwearied perseverance of a single individual raised to a degree of notice and perfection, that has had the happiest effects in bringing the improvement of our domestic animals to a state of excellence, perhaps, unequalled in any other country."

In the breeding of horses, the principles laid down above must be likewise attended to, though it is sufficiently obvious, that many of the properties that are necessary to be considered in the breeding of such sorts of live-stock, as are to be converted to the purposes of the butcher, are, in this case, to be wholly disregarded. The attention of the breeder in rearing animals of this sort, is chiefly to be directed to those points which regard their utility for the particular object or intention which he has in view, or the uses to which they are to be applied. In these cases it is advised, that after a brood-mare has been obtained suitable in size, frame, bone, and strength, to the wish of the breeder, and found to be perfectly free from all sorts of blemishes and defects, the choice of a stallion should be the object of his particular attention; in which should centre all the different points and good qualities that a good horse should possess; as the produce, whether male or female, much more frequently acquires and retains the

form, make, marks, and disposition of the sire than the dam. On this account, stallions with the least appearance of disease, blemish, or bodily defect of any kind, where there is the slightest probability of its being transmitted to the offspring, should be rejected as improper. And it is even considered, by some, necessary to descend to the minutiæ of symmetry in the head, neck, shoulder, forehead, ribs, back, loins, joints, and pasterns, attending even to a strict uniformity in the form, make, and texture of the hoofs: and, were it possible, even to ascertain the temper and disposition of both sire and dam, in order to avoid the procreation of vices or imperfections. See *Horse*.

Breeding-*Farm*, that sort of grass-farm which is chiefly employed in the breeding and rearing different sorts of live-stock. For this kind of management, whether for neat-cattle, sheep, or horses, a considerable extent of pasture-land is necessary, for the purpose of keeping the animals constantly well fed, and having them properly changed into different fields; as well as keeping the different sorts and ages in different inclosures, in order that they may be brought forward to the greatest advantage and improvement. The principal circumstance to be regarded in this sort of farming is, that of keeping the pastures in a proper condition, and fed down in a regular even manner, being constantly careful, that the stock never are in want of food, and well supplied with water. See *Farm*, *Pasture*, *Grazing*, and *Cattle*.

Breeding *in and in*, a provincial mode of expression frequently made use of, in the midland and some other districts, to signify the breeding from the same sorts of animals, without crossing or intermixing different breeds. See *Cattle*.

Breeding-*Stock*, that part of the farmer's live-stock from which he breeds or raises his young animals. This should always be the best of the particular kind to which it belongs.

Breeding-*Ponds*, such ponds as are employed for breeding of fish. The qualities of a pond, to make it serve well for breeding fish, are very different from those which are to make it serve for the feeding of them: insomuch, that some particular ponds serve only for one of these purposes, and others for the other; and scarcely ever the same pond is found to answer for both. In general, it is much more rare to find a good breeding-pond than a good feeding one. The best indications of a good breeding-pond are these, that there be a good quantity of rushes and grass about its sides, with gravelly shoals, such as horse-ponds usually have. The spawn of fish is prodigiously great in quantity; and where it succeeds, one fish is able to produce some millions. Thus, in one of these breeding-ponds, two or three melters, and as many spawners, will, in a very little time, stock the whole country. When these ponds are not meant entirely for breeding, but the owner wishes to have the fish grow to some size in them, the method is to thin their numbers; for they would otherwise starve one another. It may also be necessary to put in other fish that will prey upon the young, and thin them in the quickest manner. Eels and perch are the most useful on this account, because they prey not only upon the spawn itself, but upon the young fry from the first hatching to the time they are of a considerable size. Some fish are observed to breed indifferently in all kinds of waters, and that in considerable plenty: of this nature are the roach, pike, and perch.

BREW-HOUSE, a house erected for the purposes of brewing. The conveniency of water is one of the first things to be attended to in erecting buildings of this kind, as the frequent carriage of that necessary article greatly enhances the cost of the liquor. The water should be soft; and, if supplied from an adjacent river, it should be conveyed, by a passage under ground, into a reservoir, in order to its being pumped up from thence into the copper, or into troughs properly placed for conducting it where it may be wanted. If it be a reservoir for rain-water, it should be made as near the brew-house as possible.

The quality of the water made use of is a principal consideration in brewing, as to this, in a great measure, is owing the superiority of the beer of some particular places, as Ramsbury in Wiltshire, Burton on Trent, Dorchester, &c.

Water for brewing, when too hard, may be softened by chalk, and various other calcareous substances that may be obtained in different places.

The brew-house should likewise be situated so as to face the north, to afford shade and coolness; and as near as possible to the cellar, that the labour and expense attending the carriage of the liquor may be saved, and the danger of exposing it to either too hot or too cool an air prevented. The floor should be paved with stone or hard bricks; and raised in the middle, to give an easy discharge to the water, so as to keep it constantly clean. The copper must always be proportioned to the quantity of liquor intended to be brewed; and should be raised so high that it may run from it to the mash-tub, and the wort to the coolers. For this purpose there should be either a cock in the side, at the bottom of the copper, or a brass pump fixed in it, by means of which the wort may be conveyed through a trough to its proper receptacles. The mash-tub should be round, but not too deep, and perfectly smooth on the inside; and may have a false bottom to serve as a strainer, when, by turning a cock placed below, the wort may be drawn off into the receiver; or it may be let out by means of an upright plug, surrounded with a basket-strainer. The receiver should be lined with milled lead, which is easily kept perfectly clean, and is not apt to contract any bad taste or scent, as wood is known to do notwithstanding the greatest care. The best method of conveying the wort from the receiver to the copper, is by means of a hand-pump. There should be two coolers, or backs, as the brewers call them: these should also be lined with milled lead, or made of the heart of oak, rendered perfectly smooth, and placed as near as convenient to the copper. The working-vessel, or tun, should be placed at some small distance from the cooler. It should be round,

but not lined with lead; as this might cool the liquor too much in cold weather during the fermentation.

The liquor may be conveyed into the cellar and the casks by a cock and hose, or some other such easy method.

There should also be in the brew-house an oar to stir the malt in the mash-tub, with bowls, pails, and other utensils, necessary in different operations. These, as well as every other implement employed in brewing, should be boiled in the copper, or well scalded, every time before they are used. Indeed too great care cannot be taken to keep every vessel perfectly clean and sweet; for, if they are the least tainted, the liquor will contract a disagreeable taste. Where a taint is suspected, the vessels should be well washed with a strong ley of clean wood-ashes, which should be put into them scalding hot, and every joint, crevice, and hollow, be well scrubbed. If ashes cannot be had, lime may be employed, slaked in water in the vessels, which may be bunged up as soon as the ebullition is over, and not opened till some days afterwards. The more effectually to prevent any kind of filth from collecting on the sides, every vessel should be as smooth as possible; and after every brewing, be well washed with boiling water, and laid up dry. All these different vessels and utensils may be procured from the coopers, of such sizes as may be proper, according to the extent of the brewery.

BREWING, the operation of preparing beer, ale, or porter, from malt, hops, and other ingredients.

As this art depends on chemical principles, it would seem to be capable of much greater exactness and regularity than is usually the case in the process. A few remarks may serve to render the nature of the operation more clear and certain.

The usual process of brewing is as follows: The ingredients being ready, a quantity of water must be made to boil very speedily; and, while boiling, the fire may be damped, or nearly put out. When the height of the steam is over, as much of the water is to be put into the mashing-tub as is sufficient to wet the malt; and make it of a consistence just stiff enough to be rowed up. Let it stand thus a quarter of an hour: after which, another quantity of water may be added, and rowed up as before; and, lastly, the full quantity of the water may be poured upon it, and that in proportion as the liquor is intended to be strong or weak. This part of the operation is called mashing. The whole may now be left to stand two or three hours, more or less, according to the strength of the wort or the difference of the weather: then let it off into the receiver, and mash again for a second wort, in the same manner as for the first, only the water must be cooler than before, and must not stand above half the time. The two worts being mixed together, the intended quantity of hops added, and the liquor put into the copper (which being closely covered up, must boil gently for the space of an hour or two); then let the liquor into the receiver, and the hops strained from it into the coolers. When cool, the barm, or yeast, must be applied; which done, it is left to work, or ferment, till it be fit to tun up.

For small-beer there must be a third mashing; the water being nearly cold, and not left to stand above three quarters of an hour. To be then hopped, and boiled at discretion.

Thus, from the nature of the process, and the variety of circumstances that are necessary to be attended to in the conducting of it, it is evident that it must be liable to much variation, and that the success of the operation, or goodness of the liquor, must depend on the quality of the malt from which it is made, in respect to the quantity of saccharine matter which it contains, and the colour that has been given it in the act of drying; on the nature of the water in which it is infused; on the degree of heat employed in the infusion; on the length of time the infusion is continued; on the proper degree of boiling; on the quantity and quality of the hops made use of; on the proper degree of fermentation; and several other points. The qualities of malt will be considered in another place. See *Malt*.

The next thing to be regarded in the operation of brewing is the quality of the water to be employed; and here soft water is universally allowed to be preferable to hard, both for the purposes of mashing and fermentation. Transparency is, however, more easily obtained by the use of hard than soft water; first, from its inaptitude to extract such an abundance of that light mucilaginous matter, which, floating in the liquor for a long time, occasions it to be turbid; secondly, from its greater tendency to a state of quietude after the vinous fermentation is finished, by which those floating particles are more disposed to subside; and, lastly, from the mutual aggregation of the earthy particles of the water with those of the materials, which, by their greater specific gravity thus aggregated, not only precipitate themselves, but carry down also that lighter mucilage just mentioned. For these reasons, hard water is not well adapted to the brewing of porter, or such beers as require a fulness of palate, as in the London breweries, and some country situations.

The purity of water is determined by its lightness; and in this respect, distilled water only can claim any material degree of perfection. Rain water is the purest of all naturally produced; but having once descended to the surface of the earth, it is liable to a variety of intermixtures unfavourable to the purposes of brewing. With regard to others, though a matter of considerable importance, no precise rule can be laid down. Where there is liberty of choice, a preference should doubtless be given to that water which, from natural purity, equally free from the austerity of saline substances and the rankness of vegetable putrefaction, has a soft fulness upon the palate, is totally flavourless, inodorous, and colourless;—whence it is the better prepared for the reception and retention of such qualities as the process of brewing is to communicate.

The next point to be considered is, the proper degree of heat to be employed in making the infusion;

and here it is evident, that though this must be very material to the success of the operation, it is extremely difficult, perhaps impossible, to fix upon a precise standard that shall at all times fully answer the purpose. On this subject Mr. Richardson says: "The quality of the saccharine part of malt resembles that of common sugar, to which it is practicable to reduce it; and its characteristical properties are entirely owing to its intimate connection with the other parts of the malt, from which such distinguishing flavours of beers are derived as are not the immediate result of the hop. Were it not for these properties, the brewer might adopt the use of sugar, molasses, or the sweet of any vegetable, to equal advantage; which cannot now be done, unless an eligible succedaneum be found to answer that purpose. As we are at present circumstanced, a search on the other side would turn more to the brewer's account. We have in malt a superabundance of the grosser principles; and would government permit the introduction of a foreign addition to the saccharine, which is too deficient, many valuable improvements might be made from it, as we could, by a judicious application of such adventitious principle, produce a second and third wort, of quality very little inferior to the first.

"But, in these experiments, a very particular attention would be necessary to the solvent powers of the water at different degrees of heat, and to the inquiry how far a menstruum saturated with one principle may be capable of dissolving another. Such a consideration is the more necessary on this occasion to direct us clear of two extremes equally disagreeable: the first is, that of applying the menstruum pure, and at such a heat as to bring off an over proportion of the oleaginous and earthy principles, which would occasion in the beer, thus wanting its natural share of saccharum, a harshness and austerity which scarce any time the brewer could allow would be able to dissipate; the other is, that of previously loading the menstruum with the adopted sweet in such abundance as to destroy its solvent force upon the characteristical qualities we wish to unite with it, and thereby leave it a mere solution of sugar. The requisite mean is that of considering what portion of the saccharine quality has been extracted in the first wort, according to the quantity of water and degree of heat applied; and then to make such a previous addition of artificial sweet as will just serve to counterbalance the deficiency, and assimilate with that portion of the remaining principles we are taught to expect will be extracted with the succeeding wort.

"From the nature of the constituent principles of malt, it is easy to conceive, that the former, or saccharine or mucilaginous parts, yield most readily to the impression of water, and that at so low a degree of heat as would have no visible effect upon the latter. If, therefore, we are to have a certain proportion of every part, it is a rational inference that the means of obtaining it rest in a judicious variation of the extracting heat according to the several proportions required.

"A low degree of heat, acting principally upon the saccharum or sugar, produces a wort replete with a rich soft sweet, fully impregnated with its attendant mucilage, and in quantity much exceeding that obtainable from increased heat, which, by its more powerful insinuation into the body of the malt acting upon all the parts together, extracts a considerable portion of the oleaginous and earthy principles, but falls short in softness, fulness, sweetness, and quantity. This is occasioned by the coagulating property of the mucilage, which, partaking of the nature of flour, has a tendency to run into paste, in proportion to the increase of heat applied; by which means it not only locks up a considerable part of the saccharum contained therein, but retains with it a proportionate quantity of the extracting liquor, which would otherwise have drawn out the imprisoned sweet, thence lessening both the quantity and quality of the worts. And this has sometimes been known to have had so powerful an effect, as to have occasioned the setting of the goods, or the uniting the whole into a pasty mass; for, though heat increases the solvent powers of water in most instances, there are some in which it totally destroys them. Such is the presence of flour, which it converts into paste; besides those of blood, eggs, and some other animal substances, which it invariably tends to harden.

"From a knowledge of these effects, we form our ideas of the variations necessary in the heat of the extracting liquor; which are of more extensive utility than has yet been intimated, though exceedingly limited in their extent from one extreme to the other.

"The most common effects of too low a heat, besides sometimes producing immediate acidity, are an insipidity of the flavour of the beer, and a want of early transparency, from the superabundance of mucilaginous matter extracted by such heats, which, after the utmost efforts of fermentation, will leave the beer turbid, with such a cloud of its lighter feculencies, as will require the separation and precipitation of many months to disperse.

"The contrary application of too much heat, at the same time that it lessens the mucilage, has, as we have seen before, the effect of diminishing the saccharum also: whence that lean thin quality observable in some beers; and, by extracting an over proportion of oleaginous and earthy particles, renders the business of fermentation difficult and precarious, and impresses an austerity on the flavour of the liquor which will not easily be effaced.

"Yet the true medium heat for each extract cannot be universally ascertained. An attention not only to the quality of the malt, but to the quantity wetted, is absolutely necessary to the obtaining every due advantage; nor must the period at which the beer is intended for use be omitted in the account. The quality of the water also claims a share in the consideration, in order to supply that deficient thinness and want of solvent force in hard, and to allow for the natural fulness and fermentative quality of soft; a particular to which London, in a great measure, owes the peculiar mucilaginous and nutritious quality of its malt-liquors.

" Although the variations above alluded to are indispensible, it is easy to conceive, from the small extent of the utmost variety, that they cannot be far distant. If, therefore, we know that a certain degree extracts the first principles in a certain proportion, we need not much consideration to fix upon another degree that shall produce the required proportion of the remaining qualities, and effect that equal distribution of parts in the extract, which it is the business of the fermentation to form into a consistent whole."

The principal use of *boiling the worts* is to separate the grosser parts of the extract, preparatory to that more minute separation which is to be effected in the guile-tun. The eye is a very competent judge of this effect; for the concretions into which the continued action of boiling forms those parts, are obvious to the slightest inspection, whilst the perfect transparency of the interstices of the worts points out its utility in promoting that desirable quality in the beer. These coagulable parts are formed from the superabundant mucilage already mentioned; and hence they are found in greater proportion in the first worts, than in those that come after: at the same time, they are in these last so mingled with a quantity of oleaginous matter, that they become much more difficultly coagulable in the weak worts than in such as are stronger: and hence these require to be much longer boiled than the others.

" During this operation the hops are generally added, which are found to be absolutely necessary for preventing the too great tendency of beer to acidity. The fine essential oil of hops being most volatile, and soonest extracted, we are thence taught the advantage of boiling the first wort no longer than is sufficient to form the extract, without exposing it to the action of the fire so long as to dissipate the finer parts of this most valuable principle, and defeat the purposes of it. To the subsequent worts we can afford a larger allowance, and pursue the means of preservation so long as we can keep in view those of flavour, to which no rules can positively direct, the process varying with every variety of beer, and differing as essentially in the production of porter and pale ale, as the modes of producing wine and vinegar.

" The effects of not allowing a sufficient time for the due separation of the parts of the wort, and extraction of the requisite qualities of the hop, must be obvious. If we proceed to the other extreme, we have every thing to apprehend from the introduction of too large a quantity of the grosser principles of the hop, which are very inimical to fermentation; and from impairing the fermentative quality of the worts themselves, by suffering their too long exposure to the action of the fire, whereby they are reduced to a more dense consistence, and their parts too intimately blended to yield to the separating force of fermentation.

" The last step in the process of brewing is to *ferment the liquor* properly; for, if this is not done, whatever care and pains have been taken in the other parts, they will be found altogether insufficient to produce the beverage we desire. The first thing to be done here is to procure a proper ferment. There are only two kinds of artificial ferments procurable in large quantity, and at a low price, viz. beer-yeast and wine-lees. Brewers have always found it a considerable difficulty to procure these ferments in sufficient quantities, and preserve them constantly ready for use; and this has been so great a discouragement to the business, that some have endeavoured to produce other ferments, or to form mixtures or compounds of particular fermentable ingredients. See *Yeast*.

" The greatest circumspection and care are necessary in regard to the quality of the ferment. It must be chosen perfectly sweet and fresh; for all ferments are liable to grow musty. If the ferment is sour, it must by no means be used for any liquor; for it will communicate its flavour to the whole, and give it an *acetous*, instead of a vinous, tendency. When the proper quantity is got ready, it must be put to the liquor in a state barely tepid. The whole intended quantity being loosely mixed in some of the luke-warm liquor, and kept covered, and in a warm situation, more of the insensibly warm liquor ought, at proper intervals, to be added, till thus by degrees the whole quantity is put together. When the whole is thus set at work, secured in a proper degree of warmth, and kept from a too free intercourse with the external air, it becomes as it were the business of nature to finish the process.

" In the operation of fermentation, however, the degree of heat employed is of the utmost consequence. In forming the extracts of the malt, the variation of a few degrees of heat produces an important difference in the effect. In the heat of fermentation, similar consequences are the result. Under a certain regulation of the process, we can retain in the beer the finer mucilage, and thereby preserve that fullness upon the palate which is by many so much admired. On the other hand, by a slight alteration, we can throw it off, and produce that evenness and uniformity of flavour which has scarce any characteristical property, and is preferred by some only for want of that heaviness which they complain of in full beers. If a more vinous racy ale be required, we can, by collecting and confining the operation within the body of the wort, cause the separation of such an abundant portion of the oleaginous principle, as to produce a liquor in a perfect state at the earliest period, and so highly flavoured as to create a suspicion of an adventitious mixture. But though all this may be done, and often has been done, the proper management of fermenting liquors depends so much upon a multiplicity of slight and seemingly unimportant circumstances, that it has never yet been laid down in an intelligible manner; and no rules, drawn from any thing hitherto published on the subject of brewing, can be rendered at all sufficient to direct any person in this matter, unless he has had considerable opportunities of observing the practice of a brewhouse."

Care should always be taken to have casks ready, perfectly sweet and in good order, against the time

that the fermentation is completed, and the liquor ready to be tunned.

When the fermentation is at its height, all the dirt or foul yeast which rises on the surface must be carefully skimmed off: and when it begins to subside in the cask, it should be filled up with a reserve of the same liquor taken from another vessel, but by no means with that which has run over. The cask, being thus filled up, should be bunged close down, leaving the vent-hole open, or but slightly covered, till all motion in the liquor disappears, when the vent-hole should be stopped quite close. The custom of using bungs made of cork is by no means a good one; a wooden bung should always be fitted to the bung-hole as exactly as possible, and covered with a clean cloth.

BRICK, a hard material formed from a fat reddish tenacious clay into long squares, four inches broad and eight or nine long, and sometimes into other shapes, by means of wooden moulds, and being baked or burned in kilns. Common bricks, as well as other kinds, are frequently employed by the farmer for the purpose of making hollow or under drains, and constructing other small conduits for the passage of water. See *Draining of Land.*

Brick-*Earth*, a sort of rich unctuous clayey earth, from which bricks are made.

BRIDGE, a contrivance formed of wood, stone, or other materials, for the purpose of passing over rivers and other waters. In farming, bridges over ditches or other runlets may, for the most part, be made of wood. They are, however, sometimes constructed with brick, which is certainly a more durable, though in very few situations so cheap a material for the purpose.

BRIDLE, a contrivance made of straps or thongs of leather, and pieces of iron, in order to keep a horse in subjection, and direct him in travelling. The several parts of a bridle are, the bit or snaffle; the head-stall, or leather from the top of the head to the rings of the bit; the fillet, over the forehead and under the fore-top; the throat-band, which buckles from the head-band under the throat; the nose-bands, going through the loops at the back of the head-stall, and buckled under the cheeks; the reins, or long thongs of leather that come from the rings of the bit, and, being cast over the horse's head, the rider holds in his hand.

Bridles, at present, consist either of curbs, double and single; or snaffles, either single, or accompanied with a check-cord and rein; the reins either brown or black leather, quite plain, the head-stall without a nose-band, or any ornament of ribband in front. The curb-chain, and its application, is well known. The double bridle has two bitts, snaffle and curb; the latter with checks moderately long, light, and thin, and with a joint, like the snaffle, or whole, and known by several names, according to its form and effect.

And the use of a curb-bridle, which, indeed, is generally the most proper for road service, is to bring the horse's head in, to lift up his fore-quarters, and set him sufficiently on his haunches. This, of course, contributes to his going light in hand, and safely above the ground. The curb is to be used in those two paces, where stride is to be repressed, to wit, the trot and canter: in the walk and gallop, where a horse cannot lunge out too far, the snaffle is ever the most fit. The proper way to ride with the curb-bridle, is to hold both reins together, at discretion, curbing the horse no more than is absolutely necessary; for which reason, the single curb-rein, with which the horse's mouth finds no favour, is an unfair and foolish contrivance. By being constantly curbed, his mouth becomes so case-hardened, that you are even where you set out, if you intend an improvement; relieved, indeed, it is true, from the mighty trouble of holding two reins. It is necessary to observe carefully, that the curb-chain be not fastened above the snaffle-rein, and that it be hooked sufficiently loose, not to press too severely upon the horse's mouth.

The snaffle used to be formerly reckoned one of the severest bitts; at present, it generally signifies a mild one; although we have hard and sharp ones for some horses, the benefit of which is very problematical. The check, is a cord in the place of the curb-chain, which compresses the under jaw, and is intended for a hard-pulling horse. This is chiefly in use upon the course. In swift action, whether it be gallop or trot, the horse must have the free use and extension of his neck and head. In a gallop, the curb lifts a horse up too much, and besides, he cannot pull fairly and well against it.

Bridle-*Hand*, is the horseman's left hand, the right being called the spear or sword hand.

BRIDON, a sort of snaffle, with a very slender mouth-bit, without any branches. They are much used in this country. It is sometimes written *Bridoon.*

BRIGHT-BAY, in *horsemanship*, a common colour of a horse. See *Colour.*

BRILLS, in *horsemanship*, a vulgar name for the hair growing on the horse's eye-lids.

BRIM, a term applied to a sow when she goes to the boar, which is called going to brim. It is sometimes written *Brimme.*

BRINE, a sort of steep or pickle made use of in preparing it for being put into the ground, so as to prevent disease. Some liquors of this kind are noticed in the following article, and others will be afterwards described. See *Steep* and *Seed.*

BRINING *of Grain*, is the practice of steeping it in pickle, in order to prevent smut or other diseases in grain, which is made with common salt and water, of strength sufficient to float an egg; or of sea-water, with salt added to it till it is of the requisite strength. The seed is then put into it, and well stirred about: the light grains rise to the surface, and are skimmed off; the rest is put upon a sieve to drain, and new-slaked lime sifted upon it: after being carefully mixed, and when a little dried, it is put into the earth. Urine, when kept stale, is used in the same manner; and, if the seed be sowed directly, with good effect. Another preparation, which is called Italian pickle, is frequently employed:

it is this; take of nitre, three pounds; alum, one pound; vitriol, six ounces; verdigris, three ounces; wood-ashes, well sifted, six pounds. Boil the whole in a copper, with five pails of water; then add sixteen pails of water more, in which half a bushel of quick-lime has been dissolved. Mix the whole together; and, when cold, steep the seed in it for about six hours, stirring it frequently, and taking off what rises to the top: the remainder should be moderately dried, and then sown. How far practices of this sort are beneficial, or whether they are advantageous in any other way than that of hastening the vegetation of the seed, after it is deposited in the earth or soil, is probably not yet well ascertained by experiment.

BRINING *of Hay-Ricks*, a practice common in America, and some other places. It consists in mixing salt with the hay as it is stacked. In countries where salt is to be had at a very cheap rate, this may be an useful mode of preserving such hay as has been injured by too much rain, as cattle are known to be very fond of such substances as have salt mixed with them.

BRISTLE, a stiff glossy sort of hair produced by swine. When large swine are kept in great numbers, the bristles may be turned to advantage, by disposing of them to the brush-makers.

BRITE, a term applied to hops when they are over ripe or shatter, in which case they are said to brite.

BRIZA, quaking-grass, a genus of grasses of which there are several species, but none of which can probably be employed with much advantage by the farmer.

Briza *Media*, middle or common quaking-grass, which has a perennial root. The culm is upright, six or seven inches high in a dry soil, but in wet boggy places, two or three feet in height; having four or five knots on it, three of which are near the root. The leaves are from two to three or four inches in length, and a line or a line and a half in breadth; the upper one forms a sheath for the pannicle, which continues a long time within it. The pannicle is handsome, spreads very much when in flower, and has two spikelets on each branch, placed on such long slender pedicels, as to shake with the least air or motion: it is a beautiful grass, very common in pastures, especially dry ones, in most parts, and is easily distinguished by the continual shaking of the spikelets. Cattle eat it, both when green, and made into hay with other grasses, but it has no peculiar excellence, nor has it yet probably been cultivated separately. Indeed it furnishes but little food, and generally indicates a poorness of soil.

BRIZE, in *agriculture*, signifies such lands as have remained long without tillage.

BROAD-CAST, a term in farming, applied to any thing dispersed, or scattered over the surface of the land

Broad-Cast *Husbandry*, that sort of arable husbandry, in which the seed is put into the ground by spreading it equally over the surface by means of the hand.

Broad-Cast *Sowing*, that method of putting grain, turnip, pulse, clover, grasses, &c. into the soil, which is performed by means of the hand. This mode of sowing seems better adapted to the stoney and more stiff kinds of land, than that of machines, as in such grounds they are liable to be constantly put out of order, and to deposit the seed unequally. In this way the seeds are scattered over the ground, and not confined in regular rows, as is the case with the drill husbandry, which is mostly opposed to this. This mode of sowing, perhaps from its being that mostly made use of in the infancy of agriculture, has often been called the *old method*.

It has been observed by a late writer, that "in this method of performing the business, the most usual practice, especially where the ridges are equal in breadth, and not of too great a width, as five or six yards, is that of dispersing the seed regularly over each land or ridge, in once walking round; the seedsman, by different casts of the hand, sowing one half in going, and the other in returning. In doing this, it is the custom of some seedsmen to fill the hand from the basket or hopper, which they carry along with them, as they make one step forward, and disperse the seed in the time of performing the next; while others scatter the seed, or make their casts, as they are termed by farmers, in advancing each step. It is evident, therefore, that in accomplishing this business with regularity and exactness, upon which much of the success of the crop must depend, there is considerable difficulty, and the proper knowledge and habit of which can only be acquired by experience. Wherever this method of putting in the seed is had recourse to, it is consequently of importance for the farmer either to perform the operation himself, or to be careful in selecting such persons as are conversant with the business, as he may otherwise incur much unnecessary expense in the waste of seed, and run considerable risk in respect to his crops." And it has indeed been well observed, by Mr. Donaldson, "that in this way of sowing, even with the most expert seedsmen, where the lands or ridges are irregular or broader at one end than the other, a considerable waste of seed must always be the consequence; as when turning repeatedly on the same ridge, and at different parts, they cannot possibly scatter the seed with equal regularity as if it were of the same breadth, and they could regulate their casts by the line of a particular furrow-slice."

It is added, that "from the seed in this kind of sowing being scattered at random over the ground, and of course vegetating or coming up without any regularity on every part of the land, the crops cannot derive any great advantage in their growth by after-culture, except in the way of clearing them from weeds by the hand, or some other similar means; but in other methods this is not the case, as they can be much improved by hoeing and other means." And it is supposed, "probably from the ease and expedition with which crops are put in, in this mode, its requiring little knowledge or expense of machinery, and the business being capable of being performed in almost every variety of season, as well as circum-

stance of soil and preparation, that it prevails, in some measure, in most parts of the island. It is evident, however, that it is a less perfect, as well as less economical, method of practice, in many respects, than those that are described below, as the seed can neither be deposited in the soil with the same exactness in regard to depth, regularity, or proportion, nor be so placed as that the crop may be improved in its growth by culture afterwards. It may, notwithstanding, be practised with propriety and advantage in cases where the nature of the land is such as not to admit the more perfect methods, either from their being so extremely strong and stony, or so very stiff and tenacious, as to greatly impede and disturb the progress and operation of the machinery, which is necessary to be employed, or from the state of the season being so wet as to prevent the land from being sown by such means. Thus, in soils that abound much with stones; that are very stiff, wet, and clayey, as suggested above; and in all such probably as have been but recently broken up, and are not yet reduced by tillage to a state of considerable fineness in respect to their mould; this method must be had recourse to, as being the most suitable and convenient." It is likewise supposed, that "there is another situation in which it must probably, of necessity, in many cases be practised, which is that in which the extent of ground cultivated under the drill system is so great as to prevent a due attention being paid to the after-culture of the crops, by its interfering with the other necessary operations of the farm." Under circumstances of this kind, as almost every thing depends on proper culture afterwards, where machinery has been made use of, it will mostly be better to have such parts of the farm as cannot be well attended to in the above respect, sown in this method. See *Sowing*.

BROAD-WHEELED WAGGON, a four-wheeled carriage, in which the parts of the wheels that act upon the road are of considerable breadth. See *Waggon*.

BROADS, a provincial word applied to lakes or broad plats of water.

BROCK, a destructive animal. See *Badger*.

BROG, a provincial term used to signify to browse upon, or crop, as cattle in underwood.

BROKEN-WIND, in *farriery*, a troublesome disease, to which horses are particularly subject.

This complaint is attributed by most of the older writers on farriery to injudicious or hasty feeding of young horses for sale; by which means the growth of the lungs, and all the contents within the chest, are supposed to be so preternaturally increased, and in a few years so enlarged, that the cavity of the chest is not capacious enough for the performance of the necessary functions. There is great reason, however, to disbelieve this doctrine altogether: but at least those who consider a broken-wind in this light, must see that it ranks among the incurable diseases of horses: and that all the boasted pretensions to cure are vain and frivolous, since the utmost skill can amount to no more than now and then palliating the symptoms, and mitigating their violence.

A much more probable cause of broken-wind has lately been assigned by the anatomical professor at the Veterinary College, and which is supported by the appearances on dissection. This is, the *breaking of the air-vessels into each other*, so that a number of cells shall form one common bag, sometimes nearly the size of a hazel-nut.

In this disease, according to "Mr. Ryding, it frequently happens, that when the action of the blood-vessels of the lungs have been increased to a great degree, and the inflammation produced terminates without suppuration or gangrene, that the coagulable lymph of the blood is extravasated, or thrown into, and plugs up a part of the air-cells, which prevents them from performing their proper functions, and the animal not being able to take in the usual quantity of air, is obliged to inspire twice in the time which before only took up one inspiration, and this causes a double heaving of the flank or belly." And that "another cause of broken-wind is violent coughing, or violent exercise, immediately after the stomach has been distended with much food or water. This occasions a great oppression of the chest, and difficulty in breathing, and a rupture of the air-cells is the consequence. These ruptured air-cells form on the surface or edges of the lungs, and are never completely emptied in exspiration. When this is the case, the animal not being able to expel the air at one exspiration, another immediately takes place, and is attended with a very high rising of the flank, which suddenly falls. This action goes on in regular succession." And "it is observable, that large quantities of wind are found in the intestines of broken-winded horses, which may probably be owing to the great and long-continued action of the belly. The latter may probably be ascribed to one of these two causes—either to the loss of tone in the intestines from constitutional debility, or to the passage of air down the œsophagus, in the repeated efforts made by the animal to inspire whilst hard ridden."

But, according to Mr. Richard Lawrence, broken-wind "may be brought on by an effusion of water in the chest, or by lymph being thrown out into the cells of the lungs, and possibly by a paralysis of the diaphragm, or by the destruction of part of the lungs in consequence of inflammation. In any of these cases respiration becomes laborious, and the animal is rendered unfit for violent exertion."

In respect to the "less violent affections of the lungs, the general symptoms are, he says, manifested by coughs, which may be divided into the inflammatory and chronic kinds. In the inflammatory cough, there is generally some discharge from the lungs, but in the confirmed chronic cough, there is seldom any discharge whatever. As the horse does not expectorate through his mouth, the mucus of the lungs is coughed up into the nose, whence it is afterwards discharged by the action of snorting or sneezing. Hence, if a horse snorts after he coughs, he is generally supposed to be (although the reason is not known) sound in the viscera."

In considering the causes of broken-wind, Mr. Ryding says, "it must evidently appear, that it is an incurable disease, and our intention must be to mitigate it as much as possible. This is best done, by giving the animal small quantities of the most nutritious food and water at a time, and often, in the day; by these means preventing, as much as possible, pressure on the chest, to which may be added occasional doses of gentle purging medicines, to keep the body open."

Mr. John Lawrence advises, that "as little hay as possible should be given, and that of the hardest and best kind, on the ground, or in a basket; mashes, and an extra quantity of corn. *Carrots* are, he asserts, a specific in this case. If but a middling cart-horse, it will pay to keep him to this regimen, instead of the common garbage diet. A constant run in an upland pasture, where the bite is not too large, suits these horses best; but if once allowed this, there seems a necessity for it ever after; for if taken entirely into the stable again, their malady becomes intolerable. It is well known, although not always remembered, that asthmatic horses should be put to their speed by degrees, and that they are incapable of any violent extremes." See *Asthma*.

Hitherto no remedy for this disease has been discovered; it may, therefore, not only be necessary to lay down such methods as may probably prevent the disorder, when pursued in time; but, where they do not succeed, offer some remedies and rules for mitigating the complaint, and making a horse as useful as possible under the malady.

It is usual, before a broken-wind appears, for a horse to have a dry obstinate cough, without any visible sickness or loss of appetite; but, on the contrary, a disposition to foul-feeding, eating the litter, and drinking much water.

In attempting the cure, the natural and obvious indications are, to promote the necessary evacuations in the first instance, to attenuate the viscidity of the glutinous obstructed matter, and to deterge the passages by a stimulation of the solids. Bleeding is therefore the first measure; and it ought to be repeated at proper intervals in moderate quantities, till divested of the coat of size and livid appearance that are certain signs of the lungs being obstructed, either by viscidity or inflammation.

In order, therefore, to prevent this disorder as much as possible, bleed the horse, and give him two drachms of calomel, mixed up with an ounce of diapente, for two nights successively, keeping him clothed and well littered, and feeding him with scalded bran and warm water.

The following balls are then to be taken for some time, which have been found extremely efficacious in removing obstinate coughs:

Take of gum ammoniacum, of galbanum, and assafœtida, each two ounces; of squills, four ounces; of cinnabar of antimony, six ounces; of saffron, half an ounce: make the whole into a paste with honey; and give a ball about the size of a pullet's egg every morning.

Broken-winded horses should eat sparingly of hay, which, as well as their corn, should be wetted, in order to make them less craving after water.

Garlick is frequently found efficacious in these cases; two or three cloves given at a time in a feed, or three ounces of garlick bruised, and boiled in a quart of milk and water, and given every other morning for a fortnight, may be very serviceable, by warming and stimulating the solids, and dissolving the tenacious juices, which choke up the vessels of the lungs.

Careful feeding and moderate exercise have greatly relieved broken-winded horses. Horses sent to grass, in order to be cured of an obstinate cough, have often returned completely broken-winded, where the pasture has been rich and succulent, so that they have had their bellies constantly full. As the ill consequence in such cases is therefore obvious; where you have not the convenience of turning out a horse for a constancy, you may soil him for a month or two with young green barley, tares, or any other young herbage. To pursive thick-winded horses, Barbadoes and common tar have often been given with benefit, to the quantity of two spoonfuls mixed with the yolk of an egg, and dissolved in warm ale, fasting, two or three times a week, especially on those days the horse hunts or travels.

But in order to make broken-winded horses of any real service, the grand point is to have a particular regard to their diet, observing a just economy both in that and their exercise; giving but a moderate quantity of hay, corn, or water, at a time, and moistening the former to prevent their requiring too much of the latter, and never exercising them but with moderation, as has been before observed. The following ball may be given once a fortnight or three weeks; and as it operates very gently, and requires no confinement, except on the days it is given (when warm meat and water will be necessary), it may be continued for two or three months:

Take of succotrine aloes, six drachms: of myrrh, galbanum, and ammoniacum, each two drachms; bay-berries, half an ounce; oil of amber, a spoonful: make the whole into a ball with a sufficient quantity of honey.

Asthmatic or broken-winded horses have been much relieved in some instances, by letting them drink freely of water, in which lime has been slaked.

Mr. Taplin advises, that one of the following detergent balsamic balls be given every morning, so long as may be thought necessary to form a fair opinion whether any advantage is gained, or relief likely to be obtained:

Take of the best white soap, eight ounces; gum guaiacum and ammoniacum, each three ounces; myrrh and benjamin, aniseed and liquorice, each two ounces; balsam of Peru, Tolu, and oil of aniseed, each half an ounce; Barbadoes tar, sufficient to make a mass, which divide into twenty balls.

It is necessary to be observed, that, during this course, hay and water are to be dispensed with a very

sparing hand, so as to prevent too great an accumulation in the stomach or intestines, that an observation may be made with the greatest certainty, whether any hopes of success from medicine may be justly entertained; if not, further expense will be unadvisable, as it will appear, after such trial, an incurable malady.

The following formulæ have been found useful in Mr. Lawrence's practice:

Take of cordial ball, one pound; powdered squills, Barbadoes tar, of each two ounces. Make up the mass with honey. Or,

Take of antimony in the finest powder, eight ounces; brimstone flour, four ounces; gum ammoniacum, pounded garlick, hard soap, of each four ounces; Venice turpentine, three ounces; aniseeds, bay-berries, linseed powder, each two ounces:

Make them into a paste with honey, and oxymel of squills; giving a ball daily for a month; omitting a month afterwards, and then repeating it again, having a strict care to regimen.

This, he says, will "mitigate the symptoms of the disease, and render the horse more useful: it is also an excellent preventive where the danger is apprehended. Soften the ammoniacum by pouring a little vinegar upon it, letting it stand twelve hours; pick out any small stones or foulness, and pound it by itself; peel the garlick, add, and pound it with the gum."

He also speaks of "a course of tar-water, about four times the strength of the common; a quart or two to be given in the horse's drink." And "vitriolated copper, joined with emetic tartar, has formerly succeeded in a few instances of inveterate asthma, when every other known remedy had failed."

BROKEN-KNEES, in *farriery*, a well-known accident, or blemish, common to horses. It is observed by Mr. Taplin, that from whatever cause this misfortune may arise, the first step to relief will be to wash the parts well with a sponge and warm water, thoroughly cleansing the wounds or lacerations from every kind of gravel or sand; as these must evidently irritate and inflame the tender parts, and be productive of a discharge, which may often be entirely prevented by gently wiping dry after the use of the sponge, and plentifully embrocating the parts with camphorated lead-water, bandaging over a pledget of tow wet with the same, repeating it once or twice, if circumstances should render it necessary. This should be continued, that a crust or cicatrix may be formed to render unctuous or greasy applications unnecessary; but should the wound or laceration be so violent as to produce great inflammation, suppuration must ensue, and ought to be encouraged by applying a poultice of the common kind, and the cure be afterwards performed by regular applications of digestive ointment. It has been suggested, by Mr. John Lawrence, that there is a possibility of causing the hair to grow smooth and even with the old, after these accidents, by binding a piece of sheet-lead on the part after the wound is healed. He also suggests that, by a proper contrivance, the knees of valuable horses may be protected against this and other similar accidents. In these cases very great care must be taken to prevent all sort of inflammation, otherwise it will be impossible to prevent blemishes in the parts.

BROMUS, brome-grass, a genus of grasses, of which there are a great many species, but very few that deserve the attention of the farmer, as cattle are not much disposed to feed upon them.

Bromus *Erectus*, upright brome-grass, which grows wild in chalky pastures and stony brashy situations, to which it seems altogether confined, and constitutes a considerable part of the grassy herbage. Mr. Curtis remarks, that he has been induced to think less favourably of it, from seeing it grow wild, than when cultivated in a garden; it is, however, he thinks, deserving of trial, especially as it is early.

Bromus *Mollis*, soft brome-grass, which is a kind concerning which, Mr. Curtis says, various opinions are entertained. It has an annual or biennial root, the stalk from one to three feet in height, having five or six joints, the pannicle sometimes close, at others spreading, in meadows becoming quite smooth; the spikelets are from four to eight lines in breadth, and from one and a half to two and a half in breadth. It affords a large quantity of seed. It predominates in most of the meadows about London in the spring, and which, if it were cut on its first coming into ear, he observes, would form the principal crop, and might probably make no bad hay; but as at this period the general herbage is not considered as sufficiently forward, it is suffered to ripen, and shed its seeds, before the meadow or pasture is mown, and thus is lost, or becomes of little value; in such meadows and pastures it is yearly renewed by its seed, for it is, he thinks, an undoubted annual. As an early grass, it might probably be cultivated to advantage in the manner of rye; at present we cannot, continues he, but consider it as a weed, usurping the place, and hindering the growth of better herbage. There are many varieties of it, which differ greatly in height and pubescence.

Bromus *Secalinus*, the lob or field brome-grass, which is a great pest to corn-fields in some districts, and not inaptly, from its tall lobbing heads overlooking the corn, termed by farmers lob-grass. Mr. Sole observes, in the ninth volume of the Bath Letters and Papers, that it grows too much in meadows, and affords bad grass, and worse hay.

Bromus *Squarrosus*, strutting brome-grass, a very unprofitable sort of grass, often termed wild-oats by country people.

BROODING, the act of a hen or other bird in hatching and rearing her young.

BROOM, the name of a plant, of which there are two kinds, the common and the small broom. The common broom rises about three feet in height, with shrubby stalks, garnished with spear-like leaves, and terminated by loose spikes of yellow flowers, succeeded by short pods, which turn black when ripe, and contain four or five kidney-shaped seeds. It flowers in June or July, and the seeds ripen in autumn. The flowers of the common broom are used by the dyers to give a yellow colour;

whence it is called dyer's-broom, green-wood, and dyer's-weed.

The small broom also rises like the former, with a shrubby stalk, but only to the height of about two feet, sending out many slender branches, which are armed with long single spikes, and garnished with very small spear-shaped leaves, placed alternately on every side of the branches. The flowers branch out without spines, short, and have five or six yellow flowers growing in a cluster at the end. They come out in April and May, and are succeeded by short turgid pods, containing four or five small kidney-shaped seeds, which ripen in July. It grows naturally upon open heaths in many parts of the country.

The twigs of broom have also been found useful in thatching barns and other farm-buildings, where straw is scarce, being very tough, and of long duration. Ropes may likewise be made of the stringy fibres of the plant. Broom is also a valuable plant for the feeding or pasturage of bees. Considering it as a weed, it is one of the most pernicious plants that grows upon land; as its roots penetrate deep, and it sheds no leaves; it is continually exhausting the soil without making any return to it. The best method of destroying it, is by burning the land, then ploughing it very deep, and manuring it well with dung and ashes, or by spreading on it chalk, marl, or lime. If the ground be in pasture, it is a good way to cut it close to the ground in May, when the sap is full in it, as by this means the roots may be destroyed. In the common way of pulling up the young plants, the fibres of the roots are apt to be left, and which afterwards send forth new shoots. Foddering cattle upon broomy land is also a good way of destroying the plants.

In the southern parts of France, broom is sometimes cultivated on the poorer sorts of soil, in the same way as hemp, for the purpose of stripping the bark from it, and converting it into a kind of thread. It is likewise cultivated in these places as a winter-food for sheep, and it is said they eat it with great avidity, preferring it to many other plants. It is, however, liable to produce diseases of the urinary passages, by its diuretic qualities.

BROWN, a dusky kind of colour, inclining somewhat towards redness. A brown horse is not reckoned so beautiful as the bay or chesnut. There are, however, different degrees of this colour in animals of this kind, some being light, and others very dark. Horses of this colour have almost always black manes and tails, and often their joints are black. Almost all brown horses grow gradually lighter towards their bellies and flanks, and many are light about their muzzles. The most esteemed are those which happen to be dappled, the plain browns being considered more ordinary. Many of them are coarse, but strong and servicable for draught.

Brown *Crops*, a provincial word applied to crops of the pulse kind, as peas, beans, &c.

BROWSE, the tops or tender branches of trees on which beasts sometimes feed.

BROWSING, the act of cropping and feeding upon the young shoots of trees and plants.

BRUISE, a hurt caused by the percussion of something blunt and heavy, or proceeding from blows, falls, &c. Horses and cattle are very subject to bruises from various accidents; the general method of curing which is by bleeding, and cooling remedies, such as white wine vinegar, old verjuice, and compositions made with crude sal-ammoniac, applied frequently to the swelling, till the heat and inflammation are removed.

According to Mr. White, "in recent bruises, fomentations are the most essential remedies—when they are violent, a considerable degree of inflammation may be expected to supervene: it will then be proper, he says, to give a laxative ball, and to bleed moderately near the affected part." And where "abscesses form in consequence of a bruise, discharging large quantities of matter, particularly if the matter is of a bad colour and an offensive smell, the wound also appearing dark coloured and rotten, indicating approaching mortification, the horse's strength must be supported, by allowing him a large quantity of corn; and if he can be made to eat malt, it will be found still more effectual. If the appetite goes off, he must be drenched with good water-gruel, and a strong infusion of malt: it will be necessary also to give the cordial ball for mortification, once or twice a day. Stimulating applications to the part, such as camphorated spirit and oil of turpentine, equal parts, are of great use. Should a hard callous swelling remain in consequence of a bruise, the following embrocation is to be well rubbed into the part twice a day; and if it does not succeed in removing it, recourse must be had to a blister."

Take of camphor, half an ounce; oil of turpentine, an ounce; soap liniment, an ounce and a half: mix.

Or the following:

Take of tincture of cantharides, one ounce; oil of origanum, two drachms; camphorated spirit of wine, six drachms: mix.

There is another formula that has likewise been found useful:

Take of oil of turpentine, half an ounce; to which add gradually vitriolic acid, one drachm; oil of bays, two ounces: mix.

As a remedy where a bruise has been caused by unequal pressure from a saddle, Mr. Lawrence advises a fomentation made of stale urine, in which hay has been boiled, and red-hot iron quenched; with the addition of some verjuice. See *Contusion*.

Bruises *in Trees*, such injuries as destroy or remove the bark from particular parts. It has been observed as "a lamentable fact, by Mr. Nicol, that much valuable timber has been ruined by inattention to accidental bruises and fractures; and much, also, has been ruined by want of attention to prevent bruises, &c. How often, says he, do we find unfenced detached trees, and those standing in open woods, in a state of irrecoverable decay, proceeding from the pernicious rubbing of cattle on their boles! Did the owners of these trees, continues he, but reflect how far such bruising is injurious to the timber, and their own interests, they would not abandon plants

not sufficiently advanced in growth, and covered with strong outer bark, so as to be unaffected by such rubbing, to a fate which never fails to produce their ruin. The trifling expense of fencing detached trees, or the value of the herbage in woods, can never counterbalance the loss thus sustained." It is added, that "not one tree in ten, after being rubbed (in the rising of the sap, perhaps), is ever found to flourish, but languish, and finally decay. And how can it be otherwise, without an extraordinary exertion of nature, if, by this rubbing, the outer and inner barks are separated from each other, and also from the wood, and if the sap-vessels are distorted and broken? We might as soon suppose, that although the wrist were bared to the bone, the hand or shoulder would remain unaffected." But he supposes, that "for such wounds, it may be very difficult to prescribe a cure; but it is in the power of every one to prevent the necessity of it. We frequently see trees wantonly bruised by the wheels and frames of carts, coaches, &c. In this case, although we may venture to prescribe a remedy, we certainly have also to lament its being necessary; inasmuch as scars on the bark, or blemishes in the wood, unavoidably follow, though the tree may, in most cases, resume its wonted vigour." And it must be a matter of regret to have "the necessity of applying a cure to bruises and fractures, not unfrequently occasioned by the violence of prevailing winds, in tearing off the boughs of some, and throwing other trees down in such a manner, as to bruise or maim those left standing. This misfortune we cannot prevent; nor, at all times, that of maiming trees, in thinning of grown woods which have been neglected, and where they stand close together."

It, therefore, becomes our duty, first, so soon as a fracture, from whatever cause, occurs, to cut in to the quick or sound wood, to smooth both it and the edges of the bark, and, when sufficiently dried, to lay the wound over with thin tar, as directed below. If an upright bough, or the leader, be the object of this care, it will be necessary, for the insurance of a successful cure, to cap it with lead, &c.

In all cases it is advised, that "so soon as a bruise on the trunk occurs, to examine whether the bark only be wounded, or whether the wood be also affected; for it will often happen, that an oblique stroke will simply peel the bark, without injuring the wood." In this case, Mr. Nicol recommends us to "smooth the edges of the bark with the knife, wipe the bared part dry with a woollen cloth, and apply thin tar over the part. But if both bark and wood are bruised, let them be previously smoothed with the knife, &c. then apply the plaister; which afterwards keep in such condition as to prevent the penetration of moisture. Nature will not fail to do her part; the wound will soon be covered with fresh bark, if health and vigour prevail."—This is for fresh bruises.

But "the necessary treatment of such as have been neglected, and by which the signs of mortification and decay are produced," must be different.

"Here we are certainly, he thinks, much indebted to Mr. Forsyth, for his hints. But although he deserves the fullest credit for his ingenuity and perseverance, in the composition and application of his plaister; he is inclined to think he might have been equally successful, and yet have spared himself much trouble." For "we cannot suppose, says Mr. Nicol, that this plaister, more than any other composition just calculated to exclude air and moisture, and to resist the action of the atmosphere, can have the magical charm of making a seemingly dead stump shoot forth and produce sound timber. If we find, continues he, a simple ingredient, devoid of any pernicious quality, to answer this desirable purpose equally well, are we not, he asks, justified in the use of it, provided it can be as easily procured? Whether, says he, shall we expect, that a simple extract, which is to be employed in the cure of a vegetable, or a composition of animal, vegetable, and mineral matter, would be most safely applied? Perhaps either with equal safety. Granted: and with equal effect too, as has been repeatedly proved." He "would now beg to know, whether this celebrated composition be better fitted to exclude moisture, and resist the action of the atmosphere, than a simple ingredient which has been used for ages past, both by sea and land, and for which we have not yet, he thinks, found a substitute equivalent, namely, tar? And he would also beg to know, which of the two is most easily procured, either with respect to expense or trouble; which would last longest when applied, or keep best in readiness against accidents?" He has "no objection to powder of alabaster, wood-ashes, or bone-dust; but has found fine sand, brick-dust, or sand produced by rubbing a chip of free-stone with the finger, as useful, effectual, and durable." In fine, he considers it "a matter of indifference whether the wound be laid over with Mr. Forsyth's plaister, tar afterwards strewed with sand, &c. or any mild paint. If air and moisture are effectually excluded, the effect is, in his opinion, the same. But, by using tar, much trouble is spared; because, it is not so apt to scale off as paint; nor, in case of the necessity of renewing the plaister, does it require the pains of scraping and brushing the edges, &c. for mouldiness never follows when tar is applied. Coal-tar is to be preferred; it acquires a close, glossy skin, and is exceedingly durable."

But though Mr. Nicol may think so highly of the use of tar, in these cases, we are convinced, from much actual experience, that tar is much more readily decomposed by the effects of the atmosphere, than the composition recommended by Mr. Forsyth, and of course that it is less proper for the purpose. But though he disapproves of the composition, we are not, he says, to deviate from Mr. Forsyth's directions of "preparing the tree properly for its application, by cutting away all the dead, decayed, and injured part, till we come to the fresh, sound wood; leaving the surface of the wood very smooth, and rounding off the edges of the bark with a draw-knife or other instrument, perfectly smooth, which must be particularly attended to."

He adds, that "it is really astonishing what exertions nature will make in the recovery of health and wonted vigour, if this first trouble be followed up with necessary care to prevent the bad effects of lodging moisture, until the wound is completely covered over with new bark. And although the wound will unavoidably cause a blemish in the wood at the part effected, yet, by this treatment, infections, or the further decay of the rest of the tree, will be prevented."

BRUISING *of Grain*, the operation of crushing or breaking down grain, or other substances, by means of mills or other machinery, for the purpose of being used as food for animals, or in other modes. With regard to the advantages of this practice, in so far as it relates to the feeding of horses, or other sorts of teams, there have been very different opinions. But it has been remarked by a late practical writer on husbandry, "that it is probable, that by having the oats broken or bruised, not ground, as has been often recommended, some saving in that expensive article may be made; as it has been contended by some, that horses do not thrive so well when the oats are prepared by grinding. It is probable that, when reduced into so fine a state, they may not be so well digested, from their being swallowed more greedily, and without the saliva of the animal being so intimately blended and combined with the substance of them, as when left so that some degree of chewing becomes necessary. But even when given in the whole state, some horses swallow much of them without due mastication, as is obvious from their being voided in a perfect state, and so little changed as to be capable of supporting poultry, and other granivorous birds. Consequently something in this matter depends upon the habits of eating in horses."

It has, however, been stated by Lord Dundonald, as the result of much experience in the keeping of horses in the working of an extensive colliery, that a considerable saving may be made by the using of the grain in a bruised state. A set of experiments made in such a manner as to fully ascertain the comparative advantages of the feeding of teams with bruised or unbruised grain, would be of great utility.

Bruising *Machine*, a machine contrived for the purpose of bruising different sorts of grain, pulse, &c. as well as grinding malt. It is a simple implement, and the invention of Mr. Rowntree. At *fig.* 1. *pl.* XII. is a side-view of the machine. And at *fig.* 2. is an end-view of the same machine. This machine is constructed with two iron rollers of different diameters, turned true on their axles or spindles, each roller having a cog or tooth-wheel. A roller with grooves is fixed under the hopper, to receive the grain from the hopper, and lay it on the two rollers. To one of the rollers is fixed a fly-wheel. The machine is made to be worked by hand, or any other power. The upper wood frame is made to slide, and is regulated by a screw, according to the size of the grain, and will bruise it more or less, as may be required.

a a, the handles; *b b*, the rollers for bruising the grain; *c c*, the cog or tooth-wheels for turning the rollers; *d*, the plated roller, which receives the grain from the hopper *e*; *f*, the sliding frame; *g*, the screw for regulating the rollers; *h*, the shoot or trough for conveying away the grain from the rollers; *i*, the fly-wheel, for regulating the motion; *k*, two scrapers, hanging on centres, for keeping the rollers clean; *l*, the frame.

BRUSH, a provincial word applied to stubble, as a wheat or oat-brush, &c.

Brush-*Wood*, the small slender wood or spray-wood.

BRUTE, a general name for quadrupeds of different kinds.

BRYONY, a well-known plant, the root of which grows to a very considerable size, and which may probably be rendered useful as an article of food, by the expulsion of its acrid properties, either by fire or other means.

BUCK, the male of the deer, the hare, and rabbit kinds of animals. See *Deer*.

Buck-*Bean*, a plant with large oval leaves, growing in wet boggy situations.

It has been asserted, but perhaps without sufficient observation, that sheep, when sound and in health, always avoid eating this plant; but that when the symptoms of the rot begin to attack them, they search for it, and devour it greedily. See *Bog-Bean*.

Buck-*Heading*, a provincial word applied to the cutting any hedge-fences off, fence-height.

Buck-*Stalling*, a provincial word applied to the operation of cutting hedge-thorns, fence-height, &c.

Buck-*Wheat*, the name of a particular species of grain. It is a plant known in almost every part of the world. It is said that, in China and Japan, it forms a very considerable portion of the food of the inhabitants; it is likewise generally eaten in Switzerland, and the southern parts of France; and, in Flanders, it is one of the most considerable branches of husbandry. Gerard speaks of it as cultivated in England about the year 1597, particularly in the counties of Lancashire and Cheshire. It appears, however, to have made very small progress in this kingdom, and has perhaps received less attention than it deserved.

It is said by some to thrive well in any soil, even those of the poorest kinds; and in most of the arable districts it is sown on the inferior sorts of land, as when cultivated on the richer kinds of soil it is found to run too much to straw. It is well adapted to light sandy soils.

Mr. Bannister, however, observes, in his Synopsis of Husbandry, that it delights in land which has been reduced into good order by tillage, and has likewise partaken liberally of the dung-cart, for which reason it often succeeds a crop of turnips; and there is this advantage attending the cultivation of it, that as, from the tender nature of the plant, it requires to be sown late, it may follow a crop of turnips that has been fed off at a time, when it would be highly imprudent to sow the ground with barley.

Mr. Young advises, that "the lands designed for

buck-wheat, in May or June, should be well tilled in April, ploughed and harrowed well at least once. It is not, he says, necessary for that grain, but for the grasses which should be sown with it, and for the important object of making all the seed-weeds grow, in order to kill them by the following tillage. This April preparation marks the land for buck-wheat. He recommends the farmers in general to try this crop. Nineteen parishes out of twenty, through the kingdom, know it only by name. It has numerous excellencies, perhaps as many to good farmers, as any other grain or pulse in use. It is of an enriching nature, having the quality of preparing for wheat, or any other crop. One bushel sows an acre of land well, which is but a fourth of the expense of seed-barley. It should not be sown till the end of May. This is important, for it gives time in the spring to kill all the seed-weeds in the ground, and brings no disagreeable necessity from bad weather in March or April, to sow barley, &c. so late as to hazard the crop. It is as valuable as barley, and is the best of all crops for sowing grass-seeds with, giving them the same shelter as barley or oats, without robbing."

And the first of the above writers says, that the proper time for sowing buck-wheat is in May, when there is no longer any danger to be apprehended from the frosts; for so tender is this vegetable at its first appearance, as to be unable at an earlier period to withstand the vernal cold, and the slightest frost in their infant state would infallibly cut off the young shoots; and as from this circumstance it must be sown at a season when dry weather may be expected, the crop does on that account not unfrequently miscarry. Being sown late, the harvest likewise falls out very backward, by which the greater part of the crop is often devoured by the hogs in the field; as this grain seldom ripens till towards Michaelmas, when the other corn stubbles have been long open. Add to this, the injury likely to accrue from rain, which may be expected to fall in great abundance at this season, so that the haulm being extremely succulent, does in the most kindly harvest require a great deal of field-room, but in a wet autumn it is a very difficult matter to get the crop home in good order; and, in such years, he has known the swarths of buck-wheat lying abroad throughout the greatest part of November. Hence is evident the great hazard which attends this grain, not only from its being exposed to the ravages of the hogs, when cultivated in open fields, as before-mentioned, but from the shedding of the seed; circumstances which will cause the returns to be very trifling when threshed. To this may be added, the inferior value of the straw, chaff, &c. when compared with an oat or barley-crop.

On the light sandy sorts of land, there is, it is said, by a writer in an useful work, no crop more useful "to follow the *ruta baga*, or other turnip, which has been eaten off late in the spring, or where it is desired to sow down a field with grass-seeds, that has not been thoroughly cleansed from weeds by the preceding fallow; as the time of sowing it (which in this climate ought not to be earlier than the first week in June) gives every opportunity for getting the land into fine order. Buck-wheat is said to destroy weeds; but this is a circumstance the writer can by no means assert; as, in his practice, he has noticed the contrary: and it appears to him a singular preposition, though one which some have endeavoured to prove, that buck-wheat, from the closeness of its growth at the top, should smother and destroy weeds, whilst clover and the other grass-seeds receive considerable benefit by the shade it affords them from the piercing heat of the sun: Therefore, although he strongly recommends the sowing of grass-seeds with buck-wheat, when there is not sufficient time to prepare the land for a barley or oat-crop, he would not by any means advise the farmer to trust to buck-wheat for destroying those weeds that may remain in the ground, but endeavour by every possible care to extirpate them entirely; as the first principle of agriculture must be the thorough cleansing of all land from weeds. The quantity of seed should not be less than two bushels, or more than two and a half bushels, Winchester measure. When grass-seeds are sown, the smaller quantity will be quite sufficient, taking care to harrow the buck-wheat exceedingly well, before the other seeds are sown; and when they are sown, he finds it the most advisable practice to roll them directly, and harrow only once immediately after. It will be remembered, that in these directions, he is speaking only of such descriptions of land, as contain a considerable portion of sand or moor; for he is of opinion, that it is only on such soils, that buck-wheat can be considered a valuable crop.

The practice of the Rev. Mr. Mosely, of Suffolk, is to cultivate this crop after tares. He observes that "the excellent Norfolk method of managing light lands he generally adheres to, viz. turnips, barley, clover, and wheat; but finding, from a failure of clover in his two last crops after barley, that the succeeding ones were not equal to his expectation, he determined to try something as a substitute for that excellent preparation. Tares, he was aware, were frequently sown, and excellent crops of wheat have succeeded; but, as there were near three months between the time of cutting tares and sowing wheat, he thought that something might be done in the interim, in order, not only to keep the land clean, but to improve the succeeding crop. It was necessary to consider what would answer this end, that would not be attended with considerable expense; buck-wheat claimed the preference, as it was of quick growth, and had been recommended as a strong and lasting manure. He therefore determined to try the effects of it, and has reason to think that his expectation was not too much raised; for although he cannot with that certainty ascertain the real produce of the land as he could wish, as a considerable quantity of the wheat has been destroyed by vermin, yet still he has had the satisfaction of lodging in his granary as much as he usually has done in the common method of husbandry. The loss he sustained was, indeed, very considerable, from such small animals as

mice, for there was not a rat in the barn, and will be a standing memorial to him for threshing his corn in the proper season. It was computed at one-fourth of the whole crop. But, even deducting the loss, and allowing the increase to be equal to former years, will it not be right, he asks, sometimes to alter the usual course, and substitute a preparation equally profitable as clover for the farmer's grand crop, wheat?"

It is added, that "the land upon which this experiment was made, was light, and produced excellent turnips and barley, but seldom more than a moderate crop of wheat: twenty bushels per acre were as much as might be expected in a good season. But although he cannot speak with precision in regard to the wheat-crop, yet he can thus far affirm, that the additional profit from the rye, as spring feed, which succeeded the wheat, was more than equal to the original price of the buck-wheat. How long the effects of this manure will continue, he cannot possibly say, but, from the luxuriance of the rye, should not have made the least doubt of its operative qualities to the ripening that crop. The expense is trifling; for you cannot find any manure, even for a single crop, equal in all respects to this for five shillings, which is, in general, the price of two bushels, and is sufficient for one acre. But a material advantage there certainly is, he says, from two vegetable crops, the one immediately succeeding the other, in cleaning the land, for although the rye was sown as soon as he could conveniently plough after the haulm was carried off, yet, upon breaking up the land after the rye was fed off, it was much cleaner than it was after the last fallow. He wishes he could have drawn a more accurate conclusion from this experiment, as he finds that it is the first that has been made in this manner. It being impossible to ascertain precisely the loss he sustained, it would consequently be mere presumption to offer any thing as certain from it. He hopes hereafter to be more accurate, as he has six acres which have produced this season twelve waggon-loads of tares, and are now sown with buck-wheat, to be ploughed in the end of June, as a preparation for wheat. The field contained near six acres, including borders, and the produce was twenty-nine combs two bushels of clean wheat, so that it may reasonably be set at five combs per acre, which is a much larger crop than he expected."

This grain generally bears a price equal to that of barley, and is used for fattening of swine, poultry, and other domestic animals. In its external form, Mr. Bannister says, it bears not the smallest resemblance to wheat, and the method of culture and the progress of its growth are totally different from that grain; but when ground it produces a white flour, whence it may probably have gained the appellation. In Hertfordshire and Buckinghamshire, it is a common mode of husbandry to sow turnip-seed with buck-wheat: but the Kentish farmers usually sow their woold or weld on their buck-wheat lands; and as the seeds of either covet a light bed, and both of them require to be sown late, the woold generally succeeds well when raised among buck-wheat; and sometimes buck-wheat, turnips, and woold, are crowded together on one season. This is, however, a practice by no means to be generally adopted. The proper quantity of this grain to sow on an acre is half a bushel; and such is the uncertainty of the return, that five quarters have been produced from an acre in some years, while in others not so much as five bushels. The green haulm of buck-wheat has a peculiar inebriating effect on swine. He has seen hogs, which have fed heartily on it, come home in such a state of intoxication, as to be unable to walk without reeling.

Mr. Howard observes, that the produce may be stated, upon the average, between three and four quarters per acre; it would be considerably more, did all the grains ripen together; but that never appears to be the case, as some parts of the same plant will be in flower, whilst others have perfected their seed. It is harvested in the same manner as barley, requiring only a little more time, as, from its great succulency, it is liable to heat; on which account, it is better to put it in small stacks, of five or six loads each, than in either a large one or a barn. Buck-wheat is, he thinks, less liable to injury from a wet harvest than any of the white crops; and the straw is by no means so indifferent a fodder as many have reported. He would by no means be understood as wishing to recommend farmers to cultivate buck-wheat upon a large scale, in preference to oats or barley; but certainly it has sufficient advantages to give it a place among crops commonly cultivated, at least upon all light soils. He confesses himself ignorant of the proportion of nourishment drawn from the earth by the various plants; but it appears to him, that buck-wheat does not exhaust the soil so much as most others; he founds his opinion upon its being a leguminous plant, and growing to maturity in so very short a space of time. Men of fortune would find it, he thinks, eligible to sow in small quantities, on the borders of woods or plantations, as an alluring food for pheasants; and it is perhaps the best grain we have, for the feeding of pigs or poultry. Horses thrive well upon it; and of late years the distillers in London have bought it readily at a price equal to that of barley.

This grain is likewise sometimes sown on stiff land, for the purpose of ploughing in the stalks as a manure. On fallows where the land has a clayey bottom, this method may be pursued to advantage; but it is to be noted, that the ground should be in pretty good heart, so as to throw out a large burthen of haulm, otherwise no benefit can accrue from this mode of husbandry. At the stirring of the fallow in May, let the seed be sown pretty thick, and when the stalks have arrived to their full growth, let them be laid flat with the roll, and afterwards turned in with the plough; and when the ground has continued in this state till towards Michaelmas, by which time the stalks of the buck-wheat will be rotted, plough the seed furrows. This method of ploughing-in the

green stalks of buck-wheat, contributes much towards the melioration of stiff soils, and disposes them to work more kindly than they would otherwise have done, by overcoming that adhesion, which is the greatest evil that attends this species of land.

Mr. Howard also thinks it "useful as a manure. Upon a clean fallow, he has derived considerable benefit from sowing it as a preparation for wheat; rolling it down as soon as it is in full flower, and immediately ploughing it in. Its great succulency presently, he says, brings on a degree of fermentation, that highly enriches and ameliorates the land; the only objection is, that it renders it rather too light for a winter crop. He purposes this summer ploughing-in ten acres of buck-wheat upon a poor sand, which, after a plentiful liming the next spring, he shall sow down with tares and grass-seeds, as pasture for sheep: in this case, the lightness and amelioration of the soil will be of infinite service; seeds always coming best out of the ground when in that state; and the treading of the sheep will afterward, he thinks, render the land as firm as can be required; though a heavy roller used three or four times in the summer, would level any little inequalities of surface, and benefit the grass."

If the buck be mown when coming into flower, and led home as food for draught-horses, cows, young beasts, and pigs, which is of all others the most profitable mode of using it, the grass-seeds will be much benefited.

"There is a general idea, says the above writer, that cattle of all kinds dislike it in its green or flowering state; but this is the effect of prejudice alone. All cattle, indeed, are apt at first to neglect food to which they are unaccustomed; but from his own practice, he considers this method of using it exceedingly beneficial, and he is fully convinced that it is a plant highly nutritious: pigs in particular are remarkably partial to it, and, he thinks, thrive equally well upon it as upon red-clover. It has some advantages over red-clover; it will produce a far more weighty crop, and of course makes an additional quantity of manure: it is also to be raised in the short space of two months, and that upon land which could not be got into order for any other crop; and the expense of seed is not more than one-half the expense of red-clover.

"The advantages of keeping a considerable stock upon green food in the farm-yard, throughout the year, must be generally allowed; the best farmers in almost every county in this island regularly practise it; and he doubts not but that this will daily gain ground. Red-clover certainly is the best plant we know of for this purpose (sainfoin and lucerne excepted, and these can only be raised upon particular soils): but as the same land will not grow red-clover for a number of years without change, and as all green crops should be as near the homestead as possible, to lessen the expense of leading; surely, upon a soil suitable for the growth of buck-wheat, it is a very valuable acquisition, in moderate quantities, as a variety of green food."

The author of the New Farmer's Calendar, who assures us that he speaks from much actual experience, says, that the invariable result has shown its inferiority to every other grain, but superiority over other vegetable food, namely carrots, potatoes, and the like. In the state of herbage, cattle, he knows, will eat it, but it is from Hopson's choice, as a hundred trials have convinced him. Its fitness for ploughing into the land is undoubted, on account both of its bulk and succulence. The juice of it, however, is watery, and far enough from nutritious. Hogs, he has found from numerous trials, fatten neither so fast with it, nor is the flesh so firm as that which has been fatted upon corn. He has used it in large quantities, ground, with hard-working horses, both draught and saddle, but the difference of price by no means compensated for its inferiority to oats and beans, and besides it did not always agree; as he sometimes fancied it had a kind of stupifying effect. In nutriment, however, he confesses that it is superior to carrots for working horses. He tried it with a stock of several hundred head of poultry, and it was in the same degree inferior, both with the fatting and laying stock. He does not hear that it is very highly prized even in the distillery. In fine, he concludes that buck-wheat is valuable upon land that will grow nothing else, and is produced with small expense, and that when ready, its best application is to the market.

It has been said, he observes, that this grain being black, cannot be discoloured by wet; which is by no means a practical remark, since its discolour consists in the loss of its fine black, beside which, the grain feels cold and damp, to the great injury of the sample: wet, or dry, the only real use of its haulm is under foot. To those who expect to get money by buck-wheat, he recommends early sowing, and even to allow it the manure necessary for a following wheat-crop; he should think, by such management, five, perhaps ten quarters might be obtained from an acre of good land, which would remain in excellent order for wheat. This necessarily supposes land in no want of late spring tillage. In this case, should a suspicion be entertained of the crop running too much to haulm, it might, he thinks, be advantageously rowed and hoed.

In the Rural Economy of Norfolk, Mr. Marshall remarks, that buck is propagated as grain, and as manure; and that as the main intention of its propagation, whether as a crop or as a melioration of the soil, is the same, namely, the cleansing of foul land, it may be convenient to keep the two objects in nearly the same point of view. With respect to species, there is only one; this grain having not yet, he believes, run into any varieties sufficiently striking to have distinguishing names appropriated to them. It is sown almost indiscriminately on all species of soils; he, however, thinks that light poor land has the preference: it is, says he, to this species of soil that buck seems most especially adapted. It likewise succeeds every species of crop; the state of the soil, as to foulness and poverty, being generally more attended to than either the nature of the

soil or the crop it bore last. The soil-process depends upon the state of the land, and the intention, jointly: if the soil be tolerably clean, and the buck be intended to be ploughed under as a manure, it is sown on one ploughing: but, in general, the ground is broken, as for barley or peas, to forward the fallow, and secure the crop.

The seed-process is the same for both intentions; excepting that, for a crop, the seed is sown first, namely, immediately after barley-seed; and that intended to be ploughed under is sown as soon afterwards as the ground is in a state fit to receive the seed. It is universally sown above-furrow. The quantity of seed six pecks to two bushels an acre. The growth of buck is so rapid as to outstrip and smother almost every species of weeds: an excellency peculiar to this crop. The method of ploughing buck under, and the after-management of buck-fallows, is nearly as for wheat. The harvest-process is like that of barley, as is that of its farmery and management; except that the straw being fit for litter only, and the grain being wanted for the fattening of pigs in autumn and the beginning of winter, it is frequently threshed out immediately after harvest, before the live-stock are taken into the farm-yards.

It is recommended in the first volume of the Annals of Agriculture, in feeding horses, to try the efficacy of buck-wheat, mixed with bran, chaff or grains, either in the whole, or broken in a mill, as a bushel of it, which goes further than two bushels of oats, even with beans, mixed with at least four times as much bran, will be full feed for any horse a week, and much less hay will do. It is also further remarked, that in fattening hogs eight bushels of buck-wheat meal will go as far as twelve bushels of barley-meal. In the feeding of poultry and pigeons, it is likewise highly useful and advantageous, and they eat it with great avidity.

BUCKET, a sort of common bow-handled pail.

BUCKLE-HORNS, a provincial word applied to short crooked horns, turning inward in an horizontal manner.

BUD, that part of trees or shrubs which first begins to swell or sprout forth.

It is remarked by Doctor Darwin, in his Phytologia, that vegetable embryons are produced in the buds on the stems or branches of trees, which may be termed the viviparous progeny of plants, in contradistinction to those from seeds, which may be termed their oviparous progeny. These buds are either leaf-buds or flower-buds, or both in one covering; the bud is termed the hybernaculum, or winter-cradle, of the embryon-shoot, and is covered with scales, and often with a resinous varnish, as in tacamahacca, to protect it from the cold and moisture of the ensuing winter, and from the depredation of insects. These, by inoculation or ingrafting on other stems of trees, or by being planted in the earth, become plants exactly similar to their parents. A small glass inverted over these buds, when set in the earth, contributes to insure their growth, by preventing too great an exhalation; otherwise they are liable to perspire more than they can absorb before they have acquired roots. In this situation a greater heat may be given them, as in hot-houses, without increasing their quantity of perspiration, which ceases as soon as the air in the glass is saturated with moisture; and the increase of heat much contributes to the protrusion of their roots and new buds, as they can at the same time bear to be supplied with a greater quantity of moisture. Every bud of most of the deciduous trees of this climate, may therefore be considered as an individual biennial plant, as distinctly so as a seed; that is, the bud, like a seed, is formed in one summer, grows to maturity in the next, and then dies. In some trees, nevertheless, of this climate, as the mock orange, philadelphus, acacia, viburnum; and in the evergreen shrubs or trees, as holly, laurel, vinca, heath, and rue; and in all those herbs commonly called annuals, and in most of the trees of warmer climates; the buds appear to be formed in the vernal months, and to arrive at their maturity during the same year, and may therefore properly be called annual plants. The bud of these herbs, which are commonly called annuals, rises in the bosom of a leaf; and, as it adheres to its parent, requires no female apparatus to nourish it, but gradually strikes down roots from its caudex into the ground, which caudex forms a part of the bark of the increasing plant. This occurs in those herbaceous vegetables, which have just risen from seeds, the buds of which are properly individual annual plants, which grow to maturity adhering to the parent, and do not therefore resemble a seed or egg, as there is no reservoir of nutriment laid up for them. This circumstance also happens, he supposes, to the evergreen shrubs and trees of this climate, as to heath, rue, box, pine, laurel; for in these vegetables, as the leaf does not die in the autumn, it continues to oxygenate the blood or juice, and to supply nourishment to the bud in its bosom during the fine days of winter, and in the spring, and survives till near midsummer; that is, till the new bud has expanded a leaf of its own. Whence the doctor supposes these evergreens lay up in summer no store of nutriment in their roots or alburnum for the sustenance of their ensuing vernal buds; and have thence probably no bleeding season, like deciduous trees.

But the embryon in a bud of a deciduous plant leaves, in the spring of the year, its winter-cradle, or hybernaculum, like the embryon in a seed, or a chick in the egg; and like these the young plants of different vegetables have previously arrived at different states of maturity. Thus Mr. Ferber asserts, that he was delighted in observing in the buds of hepatica, and pedicularis hirsuta, yet lying in the earth, and in the gems of the shrub daphne mezereon, and at the base of osmunda lunaria, a perfect plant of the future year discernible in all its parts; thus also in horse-chesnut the leaves, and in cornel-tree the flowers, are each distinctly visible during the winter in their respective buds. While in buds of many other trees, and probably in all the more backward buds, which are formed late in the summer on the lower parts of branches, and much deprived of light and air, the embryon is not so forward as to be

easily discernable; and in those shrubs or trees which are deciduous in this climate, and yet have no apparent buds in winter, as the philadelphus, mock orange, viburnum, and many shrubs. Dr. Darwin suspects there is nevertheless an embryon secreted from the blood or juice at the foot-stalk of each leaf, though it is not so forward as to protrude through the bark, and produce a prominent bud, or hybernaculum. The same he suspects to occur in respect to trees, which lose their leaves in winter, in warmer climates, in which they are said not to produce autumnal buds; as he cannot conceive by what means fresh leaf-buds can be generated in the spring, when the leaves, which constitute the lungs of the mature living part of the tree, are dead; and the whole of that mature living part, or last year's bud, consequently dead along with them. But if the caudex of the new bud be generated without the plumula or visible bud, it can certainly produce a plumula for itself in the ensuing spring, as is seen by the production of new buds, when a branch is cut off, round the remaining trunk, as is done frequently to the stems of willows.

The presence of the pith or medulla is of great importance to the growth of the new bud, as may be observed by gradually slicing a shoot of a horse-chesnut in autumn, or in the early spring. The rudiments of the seven separate ribs of the late parent-leaf, and the central pith of the bud, in its bosom, are seen to arise or terminate near the pith of the parent-shoot, where the embryon plumula is probably secreted by a gland at the bottom of the parent leaf-stalk, finds there its first reception and nourishment, and is gradually protruded and elongated by the pith, which exists in its centre, as the bud proceeds, and thus constitutes the ascending caudex or uterus of the new bud, which is resembled by the wires of strawberries, and other creeping vegetables; whereas the descending caudexes of the new buds, which form the filaments of the bark of trees, are secreted from the various parts of the old bark in their vicinity; all of which probably occur at the same time by sympathy. The pith thus appears to be the first or most essential rudiment of the new plant, like the brain or spinal marrow, medulla oblongata, which is the first visible part of the figure, the doctor believes, of every animal fetus, from the tadpole to mankind. In those plants which have hollow stems, this central cavity, though not filled with the pith or medulla, appears to be lined with it; as in picris and tragopogon; in the former the stem is not only lined with the pith, but wherever a new bud is generated on the summit of the ascending stem, or in the bosom of a leaf, a membranous diaphragm divides the cavity, and is covered with this medullary substance, which division thus distinguishes one bud from another; and in slicing away the part of the stem of tragopogon, where the new lateral bud adheres, the medulla or pith in the centre of the bud is seen to commence near that membrane which lines the stem, and to pass through the circle of arterial, venal, and absorbent vessels, which constitute the ascending caudex or uterus of the new bud, while the descending caudex of it is secreted from the various parts of the older bark in its vicinity. Something similar to this mode of the production of the buds of trees had not escaped the ingenious Mr. Bradley, who asserts, "that buds have their first rise in the pith; they are there framed, and furnished with every part of vegetation, and forced forwards to meet the air through the tender bark, and would drop on the ground, if they were not restrained by vessels, which serve as roots to nourish them; and thus as a seed takes root in the earth, a bud takes root in the tree, but with this difference, that the seed has lobes to supply it with nourishment till it can select juices from the earth; but the bud has no occasion for lobes, because it takes root immediately in the body of the tree, where the proper juices are already prepared for it."

As the seed was nourished in the pericarp by an adapted secretion from the vegetable blood oxygenated in the bractes or floral-leaves, and as a reservoir of nutriment was also prepared for it afterwards in the seed-lobes and fruit, so the bud is at first nourished in the bosom of its parent-leaf by an adapted secretion from the vegetable blood; and continues to be so nourished in annual herbs and evergreen trees, till it protrudes and expands its own leaf; but if it be a bud of a deciduous plant, which must lose its parent-leaf in winter, a reservoir of nutriment is prepared for it in the roots of some plants, as in carrots, turnips, liquorice, fern; and probably both in the roots and alburnum, or sap-wood, of trees. Thus, in the spring, the umbilical vessels belonging to each individual biennial plant, or bud of a tree, absorb moisture from the earth, and propel it upwards through the roots and alburnum, where it is mixed with a nutritious material, and carried upwards in some trees with a power equal to the pressure of the atmosphere, as in the vine, vitis, the birch, betula, and the maple, acer, which at that season bleed at every wound. At this time the buds begin to swell, and to shoot roots downwards from their caudexes into the earth; the intertextures of these caudexes constitutes a new bark over the old one, consisting of arteries, veins, and absorbents. Each bud then also puts forth a leaf, which is a respiratory organ, and resembles in many respects the lungs of animals, but differs from them in this circumstance, that the leaf requires light as well as air for the purpose of perfect respiration.

Each embryon of a leaf-bud is thus furnished with its proper respiratory organ; and as many new embryons were generated during the summer in each leaf-bud, they now pullulate in succession, each of which has like the first its appropriate leaf, which, as they successively advance, compose the annual shoots or sprigs of trees; which in some plants become of great length, as in vines and willows, consisting of twenty or thirty new leaves. Hence, if the first set of leaves be destroyed by vernal frosts, as frequently happens to ash-trees, fraxinus, and to the weeping-

willow, salix babylonica; or by the depredation of insects, which often injures our fruit-trees, and perpetually occurs in this climate to the spindle-tree, euonymus; and in Italy to the white mulberry-tree, which has its first leaves plucked off for the food of silk-worms, and to the tea-tree in China, a second set of leaves succeeds, which belong to the second embryons of the same bud. But when the bractes or floral-leaves are destroyed by insects, as sometimes happens to currant-trees and apple-trees, the fruit in the pericarp does not perish, like the first embryon of the leaf-bud above mentioned, because it is still supplied by the absorbent system of the caudex and roots of the flower-bud, which compose a part of the bark, and pass into the ground; but the fruit becomes sour and less perfect from the want of a due oxygenation of the juices from which it is secreted, though its glands may probably also receive some oxygenated blood or juice by the inosculation of the vessels of different buds, whether flower-buds or leaf-buds, with each other in the bark, on supposition that they are not all of them totally destroyed. In the axilla of each leaf is generally produced about mid-summer either a new leaf-bud or a flower-bud; if it be a leaf-bud, it becomes a branch the next year, producing many other leaves, and many other buds; if it be a flower-bud, the growth ceases, terminating in the seed. During the greater vigour of the plant the leaf-buds are solely or principally produced, as in young healthy trees; but when the vessels of the bark become further elongated, as the plant grows taller, the nutritive juices are less copiously supplied, or the buds are become more mature, and the production of flower-buds succeeds, as in Mr. Walker's experiments the sap of the birch-tree in the spring was two or three weeks later in ascending to the top of a high tree than to the lower branches. Edinb. Transact. Vol. I. Hence it happens, that the grafts from strong feeding apple-trees do not bear fruit till they are twelve or twenty years old; while the grafts from old weak trees will bear copiously in two or three years, and hence very vigorous trees, as pears, produce fruit only at their extremities; but if you decorticate about an inch of a branch of a vigorous pear-tree, and thus weaken it, that branch will flower, and bear fruit at every bud, like trees of less vigour. It should be here observed, that the words strength and weakness, when applied to the growth of vegetables, are in reality metaphorical terms, or express the effect or consequence of their producing leaf-buds or flower-buds, rather than the cause of it: whereas, it is the facility with which the long caudexes of the new buds, which form the new filaments of bark, can be generated, which increases the number of leaf-buds, and gives the tree a luxuriant or vigorous appearance; and the difficulty of generating these new caudexes which increases the flower-buds, and thus gives a less vigorous appearance to the tree.

The generation of buds seems to require a less perfect apparatus than the generation of seeds, as that of buds always precedes that of seeds, both in trees and herbs; and because the caterpillar is converted into a butterfly solely for the purpose of seminal propagation; whereas the polypus can only propagate laterally, or by buds. Hence the age of the plant is another necessary circumstance to the production of flowers, fruit, and seeds, as appears in tulips and hyacinths, as well as in apple-trees and pear-trees. About midsummer the new buds are formed; but it is believed by some that these buds may in their early state be either converted into flower-buds or leaf-buds, according to the vigour of the vegetating branch. Thus, if the upper part of a branch be cut away, the buds near the extremity of the remaining stem, having a greater proportional supply of nutriment, and possessing a greater facility of producing their new caudexes along the bark, will become leaf-buds; which might otherwise have been flower-buds; and, on the contrary, if a vigorous branch of a wall-tree, which was expected to bear only leaf-buds, be bent down to the horizon or lower, it will bear flower-buds with weaker leaf-buds, as is much exemplified by Mr. Hitt, in his Treatise on Fruit Trees. The theory of this curious vegetable fact has been esteemed difficult, but receives great light from the foregoing account of the individuality of buds. Both the flower-buds and leaf-buds die in the autumn; but the leaf-buds, as they advance, produce during the summer other leaf-buds or flower-buds in the axilla of every leaf; which new buds require new caudexes extending down the bark, and thus thicken as well as elongate the branch: whereas the flower-buds shed their seed, when they perish in the autumn, and thus require no place on the bark for new caudexes. Hence when the summit of a branch is lopped off, the buds near the extremity of the remaining stem produce new leaf-buds with greater facility, as there is more room for their new caudexes to be generated along the descending bark. But if a vigorous branch be bent down to the horizon, or below it, the bark is compressed beneath the curve, and extended above it, and thus the production of new caudexes along the bark is impeded, and in consequence less leaf-buds and more flower-buds will be generated, or the former converted into the latter, which require no new caudexes. And on this circumstance principally depends the management of wall-fruit trees, and of espaliers.

In fine, the doctor concludes that the central part of an adult bud consists, first, of a conjunction of the blood-vessels from above and below, which exists in the caudex of the bud between the beginning of the leaf-vessels and the beginning of the root-vessels, the circulation resembling that of many insects, of fish, and in the livers of quadrupeds. Secondly, that there is probably at the same place a conjunction of the absorbent vessels correspondent to the receptaculum chyli of animals. Thirdly, that there exists in each bud an organ of reproduction, which in a leaf-bud produces the lateral or paternal offspring, and in a flower-bud the seminal or amatorial one.

Fourthly, that a centre of nervous influence, as a brain or spinal marrow, or common sensorium, exists in each bud; and probably resides near this junction of the blood-vessels of the leaf and root, and of the absorbent system, along with the organ of reproduction in the caudex gemmæ.

Bud, a term made use of in some districts for a weaned calf of the first year, probably from the horns then beginning to bud or shoot forth.

BUFE, a provincial term, signifying the bough of a tree.

BUFFALO, an animal of the cattle kind, which is found wild in America and other parts of the globe. It is observed in an ingenious communication, by Mr. Turner, in the Bath Letters and Papers, that perhaps at a day not far distant, America will have the satisfaction of seeing her buffalo introduced to the attention and convenience of the English, and other European farmers. This animal might be made the farmer's best friend: he is gregarious, docile, alert, and of surprising strength; his carcase affords excellent beef; and the horns, which are jet-black, and of a solid consistence, take a polish of wonderful beauty: they can be converted into fabrics of use and ornament, such as mugs, tumblers, cutteaux, and knife-handles, &c. &c. In this way they sometimes apply them; and when ornaments of silver or mother-of-pearl are employed, the contrast with the polished black of the horn is agreeably striking. The American buffalo is, he says, properly the bison of Buffon. Immense herds of this animal roam at large in Interior America. From Green River to the Mississipi, the shores of the Ohio are lined with them. The boss on the shoulders of the buffalo is, as well as the tongue, extremely rich and delicious, superior to the best English beef. It is usual to cure the tongues for sale.

Since he has had a wish to see the buffalo domesticated on the English farms, he has observed an important fact concerning it. A farmer on the Great Kenhawa broke a young buffalo to the plough, having yoked it with a steer taken from his tame cattle. The buffalo performed to admiration. Inquiring of the man, whether he had any fault to find with the buffalo's performance, he answered there was but one objection to it: the step of the buffalo was too quick for that of the tame steer, which is a great advantage on its side. There is another property in which the buffalo far surpasses the ox, his strength. Judging from the extraordinary size of his bones, and the depth and formation of his chest, he thinks it not unreasonable to assign nearly a double portion of strength to this powerful inhabitant of the forest. Reclaim him, says he, and you gain a capital quadruped for the draught and for the plough: his activity peculiarly fits him for the latter in preference to the ox.

In this country the ingenious physiologist, Mr. Hunter, has caused buffaloes to be trained to work in a cart; at first they were restive, and would even lie down; but now they are steady, and so tractable, that they are driven through the streets of London in the loaded cart. These animals do not, however, draw greater loads than oxen of the same size and weight.

BUGLE, often denominated *Sicklewort*, or *Herb Carpenter*, the name of a low weed, which has two kinds of stalks; round creeping ones, that strike root at the joints; and upright square ones, hairy on two of the opposite sides, alternately, from joint to joint, bearing loose spikes of blue labiated flowers, of which the upper-lip is wanting: the leaves are somewhat oval, soft, slightly cut about the edges, and set in pairs at the joints. It is a perennial weed, infesting moist meadows and pasture-grounds, and which flowers in May, or sometimes later.

BUGLOSS, the name of a plant, the stalks of which are rough, round, solid, erect, undivided, and marked with black spots: the leaves are very rough, long, narrowing to a point, and placed without any certain order. The flowers are large and spacious, of a beautiful blue colour, and grow in long bending spikes. They consist of one petal divided into five roundish segments, of different sizes, and resemble a horn in their figure, expanding by degrees, from a narrow beginning. The flower-cup consists of five narrow segments, and contains four rough seeds.

As bees are very fond of this plant, it might probably be cultivated to great advantage where they are kept in considerable quantities, and as objects of profit to the farmer.

BUILDING, in *rural economy*, any kind of erection raised upon a farm. It is a business that mostly belongs to the proprietor of the lands to perform, though, in some cases, it may be necessary to be done by the tenant. In undertaking it, it is constantly proper to be careful in considering the different circumstances of the particular cases, in order that the greatest advantage and economy may be preserved that the siuation admits of, and the several buildings have the greatest relative convenience. All sorts of buildings, where bricks and mortar are employed, should be done as early in the spring as possible, and never in the winter season, where it can be avoided, in order that they may have the greater length of time to get dry, before the winter sets in. See *Farm-Buildings*.

BULB, in the anatomy of plants, a kind of large bud, generally produced under the ground, upon or near the root of certain herbaceous plants, hence denominated *bulbous*. A bulb is defined by Linnæus to be a species of hybernaculum, produced upon the descending caudex or root, consisting of stipulæ, petioli, the rudiments of the former leaves, and scales or bark. Trees which are perennial, with a woody and durable stem or trunk, have generally proper buds or gemmæ, but no bulbs.

In bulbous plants, as the tulip, onion, or lily, what we generally call the *root*, is in fact a bulb or hybernaculum, which incloses and secures the embryo or future shoot. At the lower part of this bulb may be observed a fleshy knob or tubercle, from whence proceed a number of fibres or threads. This knob, with the fibres attached to and hanging from it, is, properly speaking, the true root; the upper part being only the cradle or nursery of the future

stem, which, after the bulb has repaired a certain number of times, it perishes; but not till it has produced at its sides a number of smaller bulbs or suckers for perpetuating the species.

In bulbous roots, where the stalk and former leaves of the plant are sunk below, and formed into what is called the *bulb* or wintering of the future vegetable, the radicles or small fibres that hang from the bulb are to be considered as the root; that is, the part which furnishes nourishment to the plant: the several rinds and shells whereof the bulb chiefly consists, successively perish, and shrink up into so many dry skins, betwixt which, and in their centre, are formed other leaves and shells, and thus the bulb is perpetuated.

All bulbous roots, says Dr. Grew, in his Anatomy of Plants, may be considered as hermaphrodite roots, or root and trunk both together: for the radicles or strings only are absolute roots; the bulb actually containing those parts which springing up make the body or leaves of the plant; so that it may be regarded as a large bud under ground.

Bulbous roots are said to be solid, when composed of one uniform lump of matter; tunicated, when formed of multitudes of coats surrounding one another; squamose, when composed of, or covered with, lesser flakes; duplicate, when there are only two to each plant; and aggregate, when there is such a congeries of such roots to each plant.

From various facts and observations, says Dr. Darwin, it appears that the concentric leaves, which encircle the stems of bulb-rooted plants, are the lungs to the caudex, as one or more leaves are to the bud of a tree; and that the caudex with these leaves, and the root-fibres, constitute a vegetable being: which produces a viviparous progeny of new leaf-bulbs, or a seminiferous progeny in flower-bulbs, with a magazine of nutriment in the fleshy base of each leaf; and that the tulip produces only leaf-bulbs for four or five years from the seed, and then but one flower-bulb with many leaf-bulbs annually. But that the onion-kind, allium, generates two or three flower-bulbs in the first summer from the seed; which produce flowers and other leaf-bulbs in the second summer from the seed. And lastly, that it is probable that all bulbous roots, like the buds of deciduous trees, and perhaps of evergreen ones also, are, properly speaking, biennial plants, as they rise in one summer, and perish in the next. In tulip-roots, which have been planted too deep in the earth, and in onion-roots, a vegetable cord or process is sometimes seen about an inch long to arise from the caudex beneath the bases of the cylindrical leaves, and to form a new bulb. Similar to this appears the natural growth of the roots of potatoes; a spermatic cord arises from the old root, after the leaves are expanded in the air, to oxygenate the vegetable blood, and a new tuberous or bulbous root is thus generated. This mode of producing distant roots is exactly resembled above ground by the wires of strawberries; which may be called spermatic cords, which deposit a new vegetable being on the earth, and support it like a bud on a tree, till it can strike roots into the soil, and elevate leaves into the air. The final cause of the length of these subterraneous and aërial spermatic cords is evidently the design of placing the roots at a convenient distance from their parent-plants, that they may not incommode each other, but may both of them more readily acquire nutritious juices from the earth, and the ventilation and sunshine of the atmosphere. These embryon vegetables in the various bulbous and tuberous roots, are in very different states of maturity, as in the buds of different trees; thus, in the potatoe, the corculum or plumula of the new plant only is visible, surrounded with a farinaceous nutriment, as in many seeds; whereas in the tulip and hyacinth the flower of the succeeding year is discernible, as in the bud of the horse-chesnut. As the ripening of the seed of some bulbous-rooted plants is forwarded by destroying the new bulbs, as in orchis; and the flowering bulbs of other plants are made stronger by raising them out of the earth, and taking away the leaf-bulbs, which surround them on the same caudex; as in the customary management of tulip-roots and hyacinth-roots by the florists; he was led to suspect. that pinching off the flowers of potatoes two or three times might increase the size or quantity of the roots, as the nourishment derived from the vegetable blood to the flowers and seeds might thus be directed to enlarge the roots, and thus lay up more nutriment for the future plants. This idea he mentioned to an ingenious lady, who acquainted him a few months afterwards, that on a few roots she had made this experiment with apparent advantage.

The bulbous and tuberous roots of plants are a lateral or paternal progeny, like the buds of trees, and therefore exactly resemble the parent-plaut, and on this account may be liable to be affected by hereditary diseases, and thus to become unhealthy; whence the canker is supposed to arise in those apple-trees which have for a century or two been propagated by grafting; and the curled leaf in potatoes, which have been too long propagated by their bulbs; and the barrenness of hautbois strawberries, which have been too long propagated by wires, all which diseases are believed not to happen in these plants, if they have been recently raised from seed, but want, he thinks, further observations to authenticate the facts.

But there exists a set of bulbs, which seem to be formed by amatorial or seminal generation, and not by the lateral or paternal generation, and would therefore seem to be a viviparous sexual progeny. These are produced on the flower-stem in the place of seeds; and in process of time fall off, and take root in the earth, as is agreeably seen in the polygonum viviparum, viviparous bistort, and the magical onion, allium magicum, and leek, allium sativum. A curious question here occurs, whether the plants from these bulbs are liable exactly to resemble their parents? And whether they would be liable to hereditary diseases from a long cultivation of them in succession, as is supposed to happen to those mentioned above?

Though a perfect flower precedes the product of some summit-bulbs, as he believes in the lower part of the spike of the polygonum viviparum; yet he

suspects that the summit-bulbs of allium magicum are exactly similar to the bulbs which are produced at their roots; because, on cutting one of them horizontally into two hemispheres this morning, September 10, he observed three young bulbs inclosed in the concentric fleshy membranes of the summit-bulb in the following manner: five thick fleshy concentric coats of the general summit-bulb being taken away, there appeared one single naked small bulb; and on the sixth coat being removed two other bulbs became visible, which were included in it. Whence it seems that these stem-bulbs are as forward as those of the root, and probably are in every respect similar; and that the bractes or floral-leaves, which in seed-bearing plants secrete or prepare a nourishment for the seed, and pericarp of the flower, acquire in these bulbiferous onions and leeks a new office, and prepare a magazine of nourishment in the concentric membranes, which surround their summit-bulbs; and these may be esteemed therefore a sexual viviparous progeny of vegetables, as buds are a lateral viviparous progeny.

The bulbs already mentioned, as those of tulips, hyacinths and onions, are properly the winter-cradles, or hybernacula of the young plants, whether in their leaf-bulb or flower-bulb state: and are furnished with a magazine or reservoir of nourishment for the growing embryons, as appears in the squill, scilla maritima, which vegetates from this source of nutriment in the druggists' shops. But there are other roots termed tuberous roots, as of turnip and carrot, which consist solely of a large reservoir of nutriment for the growth and nourishment of the rising stem and future seeds; whether these are produced in the same year, as occurs when the seeds are sown early in the spring; or when their vegetation is stopped by the cold of winter, and proceeds again in the ensuing spring, as generally occurs to our turnips, the roots of which he is well informed may be much enlarged by transplantation. See *Turnip.*

In these plants the leaves, by exposing the vegetable blood to the influence of the air, prepare it for the secretion of nutriment in their knobby roots, in the same manner as nourishment is produced and reserved in the concentric fleshy bases of the leaves of onions; and in these plants, as in the onion kind, the leaves which surround the base of the new stems wither and die; as the new buds or bulbs put forth leaves of their own for the purpose of oxygenating their blood. Thus it appears, that the stem and flower of the onion, or carrot, or turnip, is a new plant, not arising immediately from the seed which was sown, but from the leaf-root or leaf-knob, if it may be so called, which preceded the production of the flower-bud or flower-stem, exactly as the flower or ear of wheat, which was shown to have three or four successive leaf-buds preceding the flower-bud.

From these observations, says he, may we conclude, that no flower-bud or flower-bulb is ever produced from a seed, without the previous interposition of one or more leaf-buds or leaf-bulbs? And that those flower-buds or flower-bulbs are either produced in one generation after sowing the seed, as the flower-bulbs of onions, which are generated and nourished at the bases of the concentric cylindrical leaves of the preceding leaf-plant, which arose from the seed; or as the stems and flower-buds of the carrot and turnip, which are generated and nourished at the base of the concentric leaves of the preceding leaf-plant. Or secondly, that they are produced in one summer, though after several generations from the seed; as the three or four joints of the stem of wheat, and other grasses, which are generated and nourished in succession in the bosoms of four or five cylindrical leaves, one at each joint; which also probably obtains in all other vegetables, which are supported by hollow stems divided by joints, and furnished with leaves at these stem-joints with or without branches, as tragopogon or picris. In these plants, where there are no branches, there is simply a new central bud; and two or more lateral new buds, beside the central one, where there are branches.

Or lastly, where the leaf-buds or leaf-bulbs, which are produced from seeds, succeed each other for some years, before they arrive at sufficient maturity to produce sexual organs, or generate a flower, as in the bulbs of tulips, and hyacinths, and the buds of trees. Whence we at length acquire a distinct idea, why seedling apple-trees are ten or twelve years before they bear fruit; though the buds or shoots taken from a tree, which already has borne fruit, and ingrafted even on a young seedling-tree, shall produce flowers in the first or second year; as these buds have already acquired that state of perfection or maturity, which is necessary to the production of sexual or seminal generation: and as it therefore possesses the age of puberty, or the maturity of the tree, we may suspect that it will sooner acquire the hereditary diseases consequent to too long unmixed successive generations, a piece of very important knowledge to the planters of orchards, which they owe to the observation of Mr. Knight.

Hence, in many plants produced from seeds, perhaps in all, one or more leaf-buds precede the flower-bud; and he supposes generally, if not always, a magazine of aliment is formed at the bases of the leaves, or in the roots, for the nutriment of the succeeding leaf-bud or flower-bud, of which it is the parent.

Thus, in the carrot and turnip the first leaves constitute the lungs of the new vegetable being, which generates the succeeding flower-stem, and secretes or deposits for it a magazine of aliment, which forms the tuberous root: and then this first plant from the seed and its leaves or lungs perish, and the root gradually shrivels up, as it is absorbed by the new flower-stem. In many plants these first or root-leaves differ in form from those of the succeeding stem, as in palmated rhubarb, and in campanula rotundifolia, which is so called from the round form of the leaves of this first leaf-bud, or root-plant, which precedes the flower-stem.

BULE, a provincial term applied to the bow-handle of a pail.

BULIMY, in *farriery*, a diseased or vitiated state of the appetite of horses. See *Appetite*.

BULL, the male of the cattle tribe of animals. According to Mr. Culley, the head of the bull should be rather long, and the muzzle fine; his eyes lively and prominent, his ears long and thin, his horns white, his neck rising with a gentle curve from the shoulders, and small and fine where it joins the head; his shoulders moderately broad at the top, joining full to his chine or crops and chest backwards, and to the neck-vein forwards; his bosom open, breast broad, and projecting well before his legs; his arms or fore-thighs muscular, and tapering to his knee; his legs straight, clean, and very fine-boned; his chine and chest so full as to leave no hollows behind the shoulders; the plates strong, to keep his belly from sinking below the level of his breast; his back or loin broad, straight, and flat; his ribs rising one above another in such a manner that the last rib shall be rather the highest, leaving only a small space to the hips or hooks, the whole forming a round or barrel-like carcase; his hips should be wide placed, round, or globular, and a little higher than the back, the quarters from the hip to the rump long, and instead of being square, as recommended by some, they should taper gradually from the hips backward, and the turls or pott-bones not in the least protuberant; rumps close to the tail, the tail broad, well haired, and set on so high as to be in the same horizontal line with his back. Bulls should be constantly well fed, and kept in proper inclosures, never being suffered to ride before they are three years old, as when the contrary is the practice, they never attain so perfect a growth.

It is observed by Mr. Lawrence, that the above description delineates that barrel-shape, which Mr. Bakewell supposed most advantageous for all kinds of animals intended to be fed for slaughter, or even used for labour; and such, probably, was the original form of the Lancashire long-horned cattle. "A round, tight, cylindrical carcase, wide in the hips, but very little promenency in the knuckle-bones; straight on the back, well filled behind the shoulders, a neck long and fine, without any superfluous skins underneath (or dewlap, so much admired by the ancients); the horns long, taper, and bending downwards, and of a deep yellowish colour; the head fine and smooth, long, and yet small; short legs, standing wide and firm; the tail fixed in a medium, not so high as to interfere with the straightness of the back, nor so low as to leave any want or vacancy in the line; the ribs forming a regular convexity, particularly that called by the graziers the first rib; but more properly speaking the last, it being the last in the beast. Animals thus formed are doubtless hardy, require a less proportional quantity of food, than more loose, or indeed deeper and squarer shapes, and feed more quickly; but the barrel-shape has yet its countervailing defects, and seems, since the days of the above celebrated breeder, to have lost ground."

The bull is chiefly kept for the purpose of propagation, though he may be subjected to the yoke, but there is no certainty of his working quietly; and the use he may make of his prodigious strength should constantly be guarded against. Bulls are for the most part naturally untractable, stubborn, and fierce; and frequently in the bulling-season absolutely furious and uncontroulable: however, by castration, they may be rendered perfectly tame and quiet, without the least diminution of their strength. They also often grow larger, more heavy and unwieldy, and become more adapted to labour, as well as more tractable, by this operation. See *Ox* and *Cattle*.

BULLS, a provincial term applied to the stems of hedge-thorns.

BULLEN, a provincial name applied to the hemp-stalk, when the bark is stripped from it.

BULLOCK, the male animal of the cattle kind, after being castrated or gelded. It is the same with ox. Animals of this kind are generally termed bullocks from two to five, six, or more years old. See *Ox*.

It is remarked by the author of the Synopsis of Husbandry, that in bullocks a smooth coat and healthy countenance are proofs of their kindly disposition, and that they will not deceive the buyer in their future progress; whereas a drooping countenance, a lank belly, and a staring coat, may be considered as unfavourable circumstances, and certain indubitable signs, either that such beasts are unhealthy, or by nature unthrifty and unprofitable. Besides these, much depends on the form and construction of the animal: a close well-set bullock, with a large dewlap, stout legs, deep chest, broad buttocks, and thick flank, will rarely deceive the purchaser; whereas those of a contrary shape, loose jointed, long legged, with a prominent back-bone, great length of body, sharp buttocks, and a belly tucked up, though to appearance larger than the first mentioned, are not likely to pay so well for their meat, and will be found much lighter in the scale from these defects.

Fattening bullocks, it is observed, require to be foddered with hay in the severity of the winter months, and for this reason it is always a prudent measure to lay in for mowing a certain portion of marsh or other good grass-land, that there may be no want of fodder in the winter and spring of the year; for it is in March and April, if those months turn out unpropitious, that stock of every kind is more apt to suffer than in the depth of winter; and when young bullocks become much reduced in flesh at that season, it is a very difficult task to raise them, and they will continue during the process of their fattening to betray marks of the check they met with in their youth, so as never to arrive at the weight when fattened, that they would have done if they had not been suffered to pitch in the early stage of their life.

Good water is likewise a very essential requisite in feeding horned cattle, and such graziers will never find their account in setting about this business, whose grounds do not abound with a continual and plentiful supply of this element; nor will the beasts thrive on dry lands though the grass should be in the

largest abundance, for bullocks require a large quantity of water to dilute their victuals, and delight in summer-time to chew the cud in pools or rivulets, where they may enjoy a cool retreat, and with alternate vibrations of the tail defend themselves from the troublesome attacks of the flies, gnats, and other insects. The time when beef generally fetches the best price is towards the month of March; hence those who are fortunate enough to have any fat beasts in the spring, are certain to make a good market of them, especially in years wherein the crops of turnips turn out deficient; as when there are large growths of this root, vast numbers of horned cattle are fattened thereon in Norfolk and the adjoining counties, and these are oftentimes brought to Smithfield in such herds, as to cause a considerable reduction in the market.

Besides the method of fattening bullocks on grass-lands, there are several others in the wealds of Kent and Sussex, where the land is the most fertile of any in the southern parts of the kingdom, and where the meadows produce a grass of the most nutritious quality, and in an abundance equal to the strength of the pasture, where the ponds and rivulets yield a continual supply of wholesome and refreshing drink, and where the hay, when well got up, possesses a virtue answerable to the green herbage: on these feeding-lands the grazier finds his account in stocking his farm with bullocks of the largest size, either from the Isle of Anglesea, or from Yorkshire, Staffordshire, or other places remarkable for breeding the most weighty beasts. These bullocks have generally been worked for some years, a practice which not only serves to render them tractable and docile, whence they lie more quiet in the feeding pastures, but which renders such beasts much more expeditious in getting into flesh, than those which have not been accustomed to the yoke. These bullocks having been raised into good condition by means of the grass without doors, are, at the approach of winter, taken into the house, where they are kept in separate stalls, and tended with a constant supply of this highly nutritious fodder, whose intrinsic goodness is often alone sufficient to complete the business, and render the oxen fit for the butcher. But, in order to accelerate the progress, troughs are set before them, which are constantly filled with ground beans, oats, &c. as likewise with oil-cake reduced into small pieces. This latter substance, though apparently not calculated to please the palate of a graminivorous animal, especially so nice a feeder as a bullock, is coveted by them with such avidity, that, after they have been a few weeks accustomed to the taste of it, they will quit any other provender to feast on this diet, so that a very small portion of hay will be required when the beasts begin to feed heartily on the cake.

But it is to be observed, that water is of the utmost consequence, and therefore should be liberally given them during the time that they are feeding on the cake; at which time they require a more copious supply of liquid than when they are confined to any other diet. Thus provided with a due supply of hay, oil-cake, and water, the beasts will make a quick progress in their fattening, and if in pretty good heart when shut up, will be ready for the butcher in March; a time, as before remarked, when beef is most likely to advance in price.

It is necessary to remark, that in the feeding of bullocks, either on hay, corn, or oil-cake, or a mixture of each, their several feeds should be given frequently, and in small proportions; for, if the fattening beasts are suffered to blow on any part of their food, they will never more be brought to eat of the same again, until compelled by hunger, a sensation which they ought never to be allowed to feel. This shows the necessity of a constant attendance on these animals, in order that their food may be given in due proportions, their water often changed, and their litter still kept fresh and clean under them; for, of all the brute creation, a bullock is the most dainty in the choice of his food, from whence he has probably obtained the appellation of neat, a term perpetually used to discriminate these cattle.

When fed with oil-cake, each beast will require eight cakes per day, which are to be broken into pieces, of which one cake will form about four. Many people divide the cake by means of a large mortar and weighty pestle; but there is a far easier and more expeditious method of performing this work, which is, by holding the cake for a few minutes before the fire, which renders it, from a very hard substance, pliable and tender, so that it may be broken with the utmost facility between the fingers to any size that may be thought necessary, though it will be prudent not to break any more at one time than may be supposed wanting for the expenditure of the current day, that the beasts may enjoy their provender every day fresh out of the loft. And here a hint is offered in respect to preserving the cake, which is, that it be laid in a dry clean loft, where it may be kept free from any extraneous mixture, but to be particularly careful that neither wet or dampness be admitted to come in contact with it, which would certainly occasion it to be mouldy, and render it totally unfit for use: this caution seems the more necessary, as the cakes are generally purchased in the summer months, when the price is at the lowest, and kept for half a year or longer before they are used, in which time it is evident that either a drip in the thatch or tiling, or a dampness in the walls or the flooring of the shed or warehouse wherein they are stowed, may bring no small detriment to the cakes; and thus the owner may suffer a heavy loss in the first expense, and be utterly disappointed in his future views.

When bullocks are fattened on turnips and hay, they require only a small allowance of water, as the moisture of the turnips in a great measure supplies the place of other liquid. They may either be turned into the field, and fed with a daily portion, by dividing the close with hurdles in like manner as is practised for sheep, or the turnips may be brought home and given to them in a yard or other inclosure; or, lastly, the beasts may be tied up in stalls, as was directed for the cake-fed bullocks. Of these

three methods, the last seems to be the most eligible, as by this means the beast will lie much more at his ease, and having his eyes detached from every object but his food, will fatten more kindly, and with greater expedition, than when suffered to enjoy a wider range. The second method of bringing the turnips into a yard, and suffering the beasts to eat them there, is much preferable to that of penning the bullocks in the field, where they will probably, not seldom, make their way into the standing turnips, and will be exposed to the inclemency of the weather; from both which circumstances, much time will be lost in their fattening. Besides, they will be less under the inspection of the owner, and therefore liable to various accidents, which might either be prevented or remedied, when the other method of feeding is pursued. The dung likewise will be totally lost when the bullocks are fed in the field, and this is a matter of great importance to a farmer; and the valuable addition, which the muck from the ox-stalls makes to the contents of the yard, being replete with the dung and stale of the beasts, may well compensate for the extra attendance required on this occasion.

Turnips, for fattening bullocks, should be those of the largest size, and, when brought out of the field into the yard, should be divested of their tops, and of the dirt which adheres to them. The tops and small turnips may be thrown to the cows and lean beasts, and the large roots, after having been thus cleansed, should be divided into three or four pieces, and flung into the trough before the fattening beasts, observing not to give too large a quantity at one time; and if any of the last serving should casually remain in the troughs when the baiting-time comes round, these must be removed for a fresh supply. The hay too, which is allowed to these beasts, either when fed with turnips or on oil-cake, should be the sweetest that can be got, and be apportioned out to them in small quantities. Turnips are more palatable, and likewise more nutritious, when given to the beasts drawn fresh out of the field; but to guard against the contingency of a frost, or of incessant rains, the first of which would render this business impracticable, and the other inconvenient, it seems a very judicious method to provide a stock of turnips in dry open weather, that they may be in readiness, at those times when they cannot be procured fresh carted out of the field. These, when divested of their leaves and tap-roots, and cleansed from the dirt, may be piled up in a covered shed, where no moisture can penetrate, and in this manner they will maintain their goodness for some months.

When bullocks are at first shut up to fatten on turnips, care should be taken that this food be given in moderation, and with a proper allowance of hay, otherwise the sweetness of the turnip may tempt the beast to feed so voraciously as to occasion too great a fulness in the maw, which is called hoving or blowing, an accident which frequently happens to ruminant animals, when taken from dry meat or natural grass to turnips, clover, or other succulent pasture. See *Hoven*.

Accidents sometimes happen to bullocks, when feeding on turnips, from pieces slipping into the throat and sticking there. To prevent suffocation, which would frequently be the consequence in such cases, the outside of the gullet should be rubbed down with a stick, in order to force the piece down into the stomach; or, should that fail, a turned stick, or piece of cane, formed so as to make a kind of probang, may be introduced into the throat, and the turnip by that means be removed.

By some, the black-red and brindled bullocks are considered as most hardy, and better disposed to fatten than those of other colours. See *Cattle* and *Stall-feeding*.

Bullock-*Sheds*, the houses in which bullocks are kept while feeding. In the construction of these buildings, attention should always be had to their being well aired, to the facility of feeding and cleaning the animals in them, and to their being kept dry and clean, by their having suitable drains and conveniences for urine and dung. In the Rural Economy of Norfolk, Mr. Marshall says, a bullock-house consists of a centre building thirty-six feet long, nineteen feet wide, and about eleven feet high to the eaves, with a pair of wide folding-doors at each end, and with a lean-to on each side, the whole length of the building, and eleven feet wide. The centre-building is the turnip-house; the lean-toes sheds for the bullocks, which stand with their heads toward, or rather in, the turnip-house, from which they are parted by a range of mangers only; having the full freedom of breathing in its spacious area. By opening the doors at each end, a sufficient degree of air and coolness may be given in close weather, while, behind, the eaves of the sheds are brought down to within five feet of the ground, and are boarded with rough boards, excepting an opening at each end for the bullocks to creep in at, to prevent too great a coldness in severe weather, thus preserving a due temperature. This shed holds twenty bullocks, ten on each side, fastened by the neck, with chains, swivels, and rings, playing freely upon posts, seven feet high. At each corner of the turnip-house is a triangular bin for the topped and tailed turnips.

In autumn, the entire building is sometimes used as a temporary barn for buck, peas, &c. and in summer, the centre part is an excellent waggon-shed: had the doors been made a foot and a half higher, it would have been an admirable refuge for loads of corn or hay, in a showery harvest. The main building is covered with reed, the lean-toes with tiles. And in the Rural Economy of Glocestershire, he observes, each bullock has a house and yard to himself, in which he goes loose, occupying them by turns, as appetite or amusement directs him, having a manger and a drinking-trough to go to at pleasure; of course he eats when he is hungry, and drinks when he is thirsty. He is also at liberty to rub, or to lick himself, as well as to keep his body in a degree of temperature as to heat and cold. Theory, says he, could not readily suggest more rational principles.

The construction of these houses varies in the minutiæ. The water-trough, for instance, is some-

times placed by the manger in the hovel or shed, sometimes in the open pen. Other less noticeable variations may likewise be seen in different buildings. But the plan and dimensions, which at present seem to stand highest in esteem, and on which several erections of this nature have been made within the last fifteen or twenty years, are the following: The building fifteen to fifteen feet and a half wide within, and of a length proportioned to the number of stalls required. The height of the plates six feet to six feet four inches, supported on the side to the north or east by close walling: on that to the south or west by posts, set on stone pedestals. The gables walling. The covering plain tiles, on a single pitch-roof. Against the back wall is a gangway, three and a half to four feet wide, formed by a length of mangers, three feet to three and a half wide, from out to out, at the top, narrowing to about fifteen inches within at the bottom. The perpendicular depth fourteen or fifteen inches; the height of the top-rail from the ground, about two feet nine inches. The materials two-inch plank, stayed and supported by posts and cross-pieces, and stiffened by strong top-rails. The dimensions of the area of the covered stalls, about eight feet three inches square; of the open pens the same.

The partitions between the stalls are of broad rails, passing from the outer pillars to similar posts, rising on the inner or stall-side of the manger, and steadied at the top by slender beams, reaching across the building, each stall, or each partition, having a beam and a pair of principals. The partitions of the pens are gates, reaching from the pillars to the boundary wall; and likewise from pillar to pillar. When they are fixed in that situation, each bullock has his stall and little yard. When in this, each is shut up in his stall, the yards form a lane, or driftway, for taking in or turning out any individual. The boundary wall of the pens is about four feet high, coped with blocks of copper-dross. On the outer side of it is a receptacle for manure; on the inner a range of water-troughs, with a channel of communication for the conveniency of filling them. The materials of the troughs, stone; of the channel, gutter-bricks, covered with slabs. These stone troughs, which are about fourteen inches by two feet six inches within, have a conveniency in their construction, which is entitled to notice; instead of the sides and ends being all of them pecked down to an angle, square with the bottom, one of the ends is left bevelling, sloping, making a very obtuse angle with the bottom. This simple variation renders them easy to be cleaned, either with the shovel or the broom.

The floor is paved with hard-burnt bricks, laid edge-way in mortar, being formed with a steep descent from the wall to a channel, from three to four feet from it, and with a gentle fall from the manger to the same channel, which becomes the general drain for rain-water and urine. At one end of the pens is a pump (where a natural rill cannot be had) for supplying the troughs of water; and, at the other, a stack of stubble for litter, which is used in the stall only, the yard being left unlittered. At one end of the building is a cake-house, at the other the rick-yard; with a door at each end of the gangway to receive the hay and the cake.

In some instances, he has seen a double range of stalls on this plan, the area between them being the common receptacle for the dung. When a number of stalls, as twenty or thirty, are required, this arrangement brings them within a convenient compass, and the two ranges, with a proper aspect, become shelter to each other. Beside these loose stalls, there are others built nearly on the same plan, but without gates, and on a somewhat smaller scale, in which the cattle are fastened to the manger, or the partition posts, with a long chain, which gives them liberty to rub and lick themselves, and move about in their stalls. In this case a water-trough is generally placed at the end of every second partition, level with the manger, with a general pipe of communication to fill them, each trough supplying two bullocks. This plan, he observes, lessens the expense in some degree, and prevents the bullocks from fouling their mangers.

In the Cotswold Hills, he remarks that each bullock has different troughs, a small one for corn, a large one for hay, with a water-trough, which runs the whole length of the shed, and is covered by a board, each bullock having a hole to drink at. See *Cattle-Sheds* and *Feeding-Houses.*

Bullock-*Stalls*, the places separated by partitions, in the sheds, where the bullocks stand and feed. They should be rather high and roomy. See *Bullock-Sheds* and *Cattle-Sheds.*

BULLS-FOOT, a term sometimes applied to colts-foot. See *Colts-foot.*

BULLWEED, the name of a perennial weed, common in corn-fields; it rises to about two feet high; the stalks are round, streaked and hoary; the bottom leaves oblong and undivided, but those which grow on the stalk are cut and divided. The flowers resemble those of the blue-bottle in shape, but are of a red colour. The seed is small, oblong, reddish and hairy in the upper part. It is frequently known by the names of *great knapweed*, or *malfellon.*

BULTER, a provincial term employed to signify the refuse meal after being dressed, or the cloth through which it is passed. See *Bolting-Cloth.*

BUN, a term signifying a hollow stem.

BUNS, the stalks of hemp from which the bark has been taken off.

BURDEN-BAND, a provincial word signifying a hempen hay-band.

BURGOT, a provincial word applied to yeast. It is sometimes pronounced *Burgood.*

BURN-BAKING, the operation of cutting or paring off the surface turf of grass-lands, and reducing it to ashes by means of fire. It is principally employed as a method of bringing into cultivation such waste and other lands as contain much coarse grass, or other vegetable products on the surface. Where this is not the case, it can seldom probably be made use of to so much advantage. It is sometimes written *Burn-beating.* See *Paring* and *Burning.*

BURNING *of Heath*, a practice employed in

some districts for clearing ground covered with this substance, in order to procure grass and herbage for cattle. The most proper time for this business is towards the latter end of the summer, when the plants are withered: care should be taken that the fire extends no further than is intended, by clearing away all the grass, and other dry vegetable matters, on the side which is to be preserved from the flames, to a distance sufficient to prevent all communication; the grass and other substances which are cut down, being spread upon the part intended to be burnt, may serve for kindling the fire after they are become dry.

For this operation, a fair calm day should likewise be chosen; when, by kindling the fire on the side the wind blows from, the danger of its spreading too extensively is more fully guarded against. If, however, notwithstanding these precautions, it should spread to places intended to be preserved, and where there is no water, the most effectual way of stopping the progress of it is to dig a trench; as, by throwing up the earth on the side where the fire is, the grass is covered, and the flames thereby hindered from extending further.

Burning *of Land.* See *Paring* and *Burning.*

Burning *of Lime*, the process of converting hard or stony calcareous substances into lime, by means of fire. See *Lime-Burning.*

Burning *of Straw*, a wasteful practice employed for manuring land in some districts.

It is observed by Mr. Young, in the Report of Lincolnshire, that the most singular practice which he ever met with in manuring subsists on the Wolds; it is that of spreading dry straw on the land, and burning it. At lord Yarborough's, he says, he first heard of this custom. His lordship's tenant, Mr. Richardson, a very good and intelligent farmer, gave him the account, having long practised it with success. The quantity is about five tons an acre. At Great Lumber, he straw-burnt a piece in the middle of a field preparing for turnips, and on each side of it manured with ten loads an acre of yard-dung, and the burned part was visibly superior in the crop. In another piece the same comparative trial was made, in 1796, for turnips, which crop was much the best on the burned part; and now, in 1797, the barley is equally superior. On another farm he had at Wold-Newton, he did it for turnips, then barley, and laid with sainfoin; and the burnt straw was better in all those crops than yard-dung. Burning gorse in this manner returns great crops; but the expense is too high. He is clearly of opinion that it is the warmth from the fire that has the effect, and not the ashes; for the quantity is nothing, and would blow away at one blast. It is proper to observe, says he, that they do not value straw used in feeding cattle at more than 4*s.* or 5*s.* a ton

Mr. Mallis, of Lumber, is of the same opinion, and thinks four tons are enough; never knew that quantity fail for turnips. This straw-burning husbandry the reporter found again at Belesby. Mr. Lloyd, who, he should observe, is an excellent farmer, thinks that it takes six tons per acre, which will last longer in its effect, and beat the dung which that straw would make, and in general lasts longer than common dunging. Keeping much cattle, he cannot practise it, but highly approves it. In discourse at Horncastle ordinary, on burning straw, the practice was, Mr. Young says, much reprobated; yet an instance was produced that seemed to make in favour of it. Mr. Elmhurst, of Hazlethorpe, burnt twelve acres of cole-seed straw on eight acres of the twelve, and the effect was very great, and seen even for twenty years. He sowed wheat on it, four bushels an acre, and had five quarters: the four acres upon which nothing was burnt, much the better land; yet the crops on the burnt part were by that made equal to the rest. But in another similar experiment for turnips, Mr. Rancliff observed the result, and the effect, though good, lasted only for one crop. Mr. Kirkham, who was in company, gave it as his opinion that, as cattle would not eat stubble, it might be beneficial to collect and stack that, and, before turnip-sowing, burn it. The Rev. Mr. Allington, of Swinop, has burnt on the land for turnips the long-straw dung from the surface of the farm-yard, and has had better turnips there than where the dung was laid. This has been the case in two experiments he has made.

About Tathwell, the reporter says, there is no burning straw upon land: Mr. Clough, Mr. Hyde, and Mr. Pearson, scouted the idea of such a thing being common. It has, however, been here tried; for Mr. Oldham, of Elkington, did it, after ploughing for turnips, with long straw from the yard, and he succeeded well for the most part.

Mr. Pontey, of Huddersfield, in Yorkshire, in the fourth volume of Communications to the Board of Agriculture, has mentioned an "instance of the effect of heat upon fallows, which, he says, may furnish matter for useful reflection. A neighbour of his has a mill, where he shells a considerable quantity of oats, the husks of which he was used to burn, and to spread the ashes upon his grass-lands; but their effects were only observable for one season, and were by no means considerable. Within the last ten years, he has fallen into the practice of spreading the said husks upon his fallow when it is dry, to the depth of six or eight inches. To these he sets fire as soon as the wind is favourable, and though the quantity of ashes be left very trifling, the article being very light, yet the soil is uniformly so enriched, that, though no other tillage be applied, the burnt part is distinguishable, from what is tilled with either lime or dung. To these effects, he has for several years been an attentive observer of the benefit for four following crops."

Burning of *Stubble*, the practice of consuming the stubble for the purpose of improving the soil. Some experiments of this sort are stated in the fourth volume of Communications to the Board of Agriculture, by Mr. William Curtis, of Lynn in Norfolk. He "occupied, under a grandfather, a farm of nine hundred acres of land, with as great diversity of soil as is, he believes, to be found, in the same compass, in any part of the kingdom. During this occupation, he made many experiments of renovating old pasture-

land by tillage, and afterwards returning it to its original state. Amidst a variety of these essays, the following appeared to him the most worthy of imitation: he recollects breaking up two pieces of old pasture-land, of an exact similitude of soil and aspect. The first piece he ploughed with a common Norfolk plough in the beginning of March, with furrows of about four inches depth. He then harrowed in, broad-cast, four bushels of oats per acre, rolling the land with a very heavy roller, as soon as the soil was sufficiently dry to permit the operation. The crop proved abundant; nine quarters per acre came to the bushel, exclusive of a very great loss which was scattered in the field: the oats were shorn, leaving the stubble about eighteen inches high. The first fine day after the oats were carried off, he took, he says, the advantage of a fair wind, and by the help of a candle and lantern, he so completely set fire to the standing stubble, as to consume every particle of it that appeared upon the surface; but previously to his so doing, he used the precaution of mowing the verges of it to prevent any injury being sustained by the surrounding hedges. This operation completely destroyed every weed and seed that grew, leaving the surface entirely covered with ashes. As soon as harvest was finished, he ploughed the land of a depth just sufficiently to conceal the ashes, and about a fortnight afterwards, he ploughed it again two inches deeper than before. By this variation in ploughing, the ashes became completely intermixed amongst that portion of the soil designed for vegetation. In the month of November he sowed it, broad-cast, with three bushels of wheat per acre, which he ploughed in furrows of about four to a yard, and at a pitch rather less than that at which it was at first broken up. This crop, like the last, proved extremely advantageous; its produce being full five quarters per acre: he now once more recurred to his fiery system, which was accomplished as before recited. Although it was his intention to have laid the land down with the second crop, he was induced, from the redundancy of its produce, to run the hazard of a third. He again sowed it with oats in the latter end of February, which he ploughed in, broad-cast, and which were reaped in the middle of July. After the oats were removed from the land, he mowed the stubble as close as it was practicable so to do, which he had directly collected, and carried into the straw-yard. Before July was expired, he ploughed the land the usual depth, harrowing it slightly, but sufficiently to fill up the principal cavities upon the surface. When this was achieved, he sowed his grass-seeds, harrowing the soil till it was sufficiently pulverised for their vegetation and security; he then rolled it down, and left it to its fate. The last crop of oats had not a weed in it. The seeds in about a fortnight sprouted with great promise, and the oats that were shed upon the land grew up and proved a most excellent nursery for them during a winter of more than usual severity. He should also have burnt his stubble in the last crop, but as it would have destroyed the oats that were shed, he omitted it, that they might answer the purpose he has just related. In the spring of the year his seeds had a most favourable aspect, when he again applied to them a very heavy roller, and in the latter end of May he stocked the land slightly with both sheep and bullocks. After the first season, the land was mown and fed in the way it had been formerly occupied, and so far was it from being injured by tillage, that the crops of both grass and hay, as long as it continued under his observation, proved infinitely finer and more abundant than any of its former produce. The grass-seeds with which the land was sown, were the shaking of the finest natural hay he could procure: three bushels of which, with the intermixture of three pounds of narrow-leafed plantain, and ten pounds of white clover-seed were sown per acre. The hay which he selected for this purpose, stood rather longer before it was cut than is the usual practice: by this method, the seeds became properly matured for vegetation, and the hay itself sustained little or no injury, either from so doing, or shaking out of the seeds, which was performed with a common fork: the soil that he has been speaking of was a loam, approaching to a clay. The other piece of land, which was only parted from the foregoing by a fence, he sowed with the same succession of crops as he previously stated, but with very different cultivation and success. When the first crop of oats was housed, the stubble was rolled down with a heavy roller, and ploughed in to rot, as is the common practice in this county. His wheat-crop which succeeded, fell short eight bushels per acre of his first, and had an infinity of weeds, from which that crop was totally exempt. Here again, instead of burning, he ploughed in his stubble, and in the ensuing spring, to keep up the exact similitude in cropping, he sowed this land with oats; harrowing in immediately after them the same compound mixture of grass-seeds as he before described. Here, as in his preceding crop, he found a considerable deficiency in his produce, and he had the additional mortification of seeing his crop of weeds increase in the same ratio as his crop of corn diminished. But this proved not his only disappointment; the combination of weeds and straw so totally extinguished every vestige of his grass-seeds, that he was compelled to re-sow the land as he had successfully effected in his first experiment. These seeds promised in the spring extremely well, and the land was stocked and fed exactly as the piece he first described. But, in the succeeding seasons, the disadvantage of his second process was proved to demonstration: the crops of hay and grass were coarse and full of weeds, and so continued to the period at which he resigned it."

It is concluded from these experiments, "that the burning of the stubble, and sowing the seeds at the time he practised it, are infinitely preferable, in every view, to any of the usages in either the old or the modern school. Where the soil is less luxuriant, he would recommend taking but two succeeding crops, and either laying the land down immediately after the second, or sowing a crop of turnips; and then, after a crop of either oats or barley, returning it to pasturage. Should the land be still of a slighter

texture, he would take only two crops in the whole, and those with the intervention of a crop of turnips, laying the land down after the last as before described. When the land is so light as to give no expectations of a redundant produce, the seeds may safely be sown at the accustomed season, but where the corn is likely to smother them in their infant state, August is indisputably the better time."

And in respect to this practice, it is further stated, that "independent of his own experimental information, he has not been an inattentive observer of the practice of his neighbours. He has seen a variety of soils turned from pasturage to tillage, and *vice versâ*; but he never saw any mode succeed equal to that of his own adoption. In all the experiments of others, the operation of burning has invariably been omitted: a measure equally calculated, he thinks, to enrich the soil, and for the extirpation of the weeds. Hence, in order to bring a piece of land into the same course with others that surrounded it, he sowed it with oats, though conscious it was extremely foul. Here harlocks, wild-poppy, and a long *etcætera* of obnoxious plants portending more injury than profit, he ploughed up one-half of it before the seeds were ripe for propagation, and the other half he permitted to stand till they were sufficiently combustible for his fiery operation. He then took his candle and lantern, and consumed them as he had done the stubble. The consequences strongly marked the advantages of his second trial. The whole piece was in the ensuing season sown with turnips, when that part that had been burnt proved infinitely cleaner, and more productive, than that which had been ploughed."

In processes of this nature, it is not possible to draw satisfactory conclusions from a few trials on one sort of soil, but there can be no doubt that the burning of substances upon land has a beneficial effect, in many cases, in improving the fertility.

BURNS, in *farriery*, accidents frequently produced in animal bodies by means of fire, by which a solution of continuity of the parts is produced. In burns, where the skin remains entire, the part may be bathed well, and kept wrapped up in rags dipped in camphorated spirits of wine with great advantage. Salt bound thick on the part has also been found very effectual for this purpose. Fresh yeast has likewise been frequently applied with considerable effect, both when the cuticle has remained, and when it has been removed. When large ulcers are formed after burns, they should be dressed with mild digestive applications, great care being taken to keep down the fungus, or what is commonly termed proud flesh. But some advise, that the wound should be dressed with powdered chalk, and a common poultice. When the horse is feverish from pain, cooling clysters should be given, and the treatment directed in simple fever employed.

When the burn is fresh, some use the juice of onions and verjuice mixed together; others, black soap and common salt; indeed any stimulating application is proper at first, but the dressings must be milder when the discharge comes on. If the horse shivers after the accident, some of the cordial-balls and warm mashes should be given. See *Ball*.

The superior advantages of stimulating applications in cases of this nature, over those of the cooling kind, have been fully shown by Mr. Kentish, of Newcastle, in a late publication on the subject.

The heat and redness which appear in the upper part after injuries of this kind, are nothing more than the inflammation which is naturally produced by such causes.

BURNT-*Clay*, such clay as has undergone the process of calcination by means of fire. In this process, it is supposed by Dr. Darwin, that oxygen is combined in large proportions, either with the clay itself or the metallic particles which it may contain, and on this account probably becomes useful as a manure. This business may be accomplished by means of clamps or kilns, or simply by piling up heaps of clay loosely together, with a little dry brush-wood, or other similar combustible materials, in the middle of them, to which the fire may be applied. In this way much manure may be easily procured, where the materials abound. Calcined clay, as a manure, is probably most proper for close compact soils, as it opens and renders them more porous, and thereby disposes such lands to part with their vegetable nourishment more readily.

It is also supposed, by the author we have just mentioned, that calcined clay, as it exists in soft bricks, has a power of decomposing marine salt, as he once observed in a cellar, where beef had been long salted on one side of a nine-inch wall, the wooden salting-tub for which was attached to it; that a great efflorescence appeared on the other side of the wall, which he believed to be fossile alkali or natron. If this idea be just, says he, the soft bricks from old buildings, or clays so far purposely burnt, may in this manner be serviceable to vegetation, by separating the fossile alkali from the sea-salt, which is washed from decomposing animal and vegetable substances, which, by converting carbon into an hepar carbonis, as lime is supposed to do, might render it soluble in water, and capable of being absorbed by the lymphatic vessels of the roots of plants. And, continues he, if clay calcined to a certain degree, and thus united with oxygen, possesses the power of decomposing marine salt, there is reason to believe, when it is more slowly united with oxygen by its exposure to the atmosphere by the spade or plough, that it may possess the same property, and that this may have given rise to the very contradictory reports concerning the use of sea-salt in agriculture, as it may probably be of great advantage to clayey soils, but perhaps not so to other soils. See *Clay*.

BURNT-*Grain*, a disease frequently met with in the ears of grain, but which is probably not yet well understood.

The characteristics of this distemper, according to some, are, that the plants which produce burnt ears are strong and vigorous; that the infected ears are not at first distinguishable from those that are healthy; but, when they are past their bloom, they appear of

a deep green colour, approaching to blue; they afterwards become whitish, and are then easily known. As this change of colour is effected by the sun, when a number of white ears have been suddenly perceived in looking over a wheat-field, the sun's heat has been often thought to cause this distemper, or a fog preceding that heat. That though all the ears produced from one grain are commonly infected, yet sound ears are met with on plants that have produced others which were infected. Some ears have even been observed, part of which only were vitiated, and, finally, some grains inclosing partly a white flower, the remainder black dust.

In burnt ears, the chaff, or outward coat, is commonly sound, with this single difference, that, when the ears are nearly ripe, it appears more withered and dry than in the healthy ears. The husk which immediately enclosed the grain is not destroyed, but has consistence enough for the grain to preserve nearly its natural form, with a whitish look; and the burnt grains are shorter, rounder, and lighter, than such as are uninfected: they are sometimes larger, and sometimes smaller. The furrow, which runs the length of a grain of wheat, is sometimes totally effaced, at others is visible: the pistils at the extremity of the grains are dried up; but the bud of burnt grain is not visible. Till the blooming season, there is very little difference betwixt the burnt grain and that which is healthy; they are only a little more swelled: but in the blooming season the infected ears assume a blueish colour; the chaff is more or less specked with small white spots; the grains are of a deeper green, and larger than a state of nature; and, as long as they preserve that colour, they adhere strongly to the chaff. The distemper has often attacked very young ears, while yet enclosed in the sheath. The stamina on the sides of the grain are then dried up and sickly; the embryo in part takes the deep green colour above mentioned; the infected ears have not the consistence of these that are healthy; in the same measure the distemper advances, the chaff becomes dry and whitish. The grains have some degree of firmness. On opening them, which may easily be done with the nail, there appears an unctuous, dark-brown, stinking substance. The dust of burnt grain has also some cohesion.

By others it is, however, supposed to originate from insects; in which view we have the following experimental remedies proposed in the seventh volume of the Bath Papers. The trials were made in the middle of a twenty-acre close, the residue of which was sowed with the same kind of wheat, and treated in the same mode, as No. I. and II. and was equally as clean, and the crops have been so ever since: The writer's mode of medicating his wheat was as in No. II.

No. I. Sowed five drills with Mr. Cooke's machine, with wheat, treated agreeable to Mr. Middleton's recipe.

No. II. Sowed five drills with wheat wetted with old urine, three quarts to a bushel, and turned about with a shovel till all the urine was imbibed; then plenty of quick-lime sifted over it, and turned over and over with a shovel, and left in a heap till next morning.

No. III. Sowed five drills with wheat steeped two hours in a strong lye, made of wood-ashes and lime, and laid on the barn-floor to dry.

No. IV. Sowed five drills with the same kind of wheat dry.

RESULT.

No. I. and II. scarce a burnt ear to be found in them.

No. III. About a twentieth part burnt.

No. IV. Near a fourth part burnt.

No. V. Picked ten good corns out of an ear, the remainder were burnt; planted them in the garden; six only vegetated, which produced seventy-two ears, one root of which only was burnt; consequently the opinion that the good corns in a burnt ear produce burnts again is fallacious, otherwise the whole must have been burnt. The above experiments seem to prove, says the writer, that wetting wheat with old urine, and drying it with lime, is a preventative; and he conceives that an insect, by depositing its egg, eggs, or seed, on the corn when growing, is the cause of burnts. Supposing this to be the case, the wetting the corn with brine, urine, or strong lye, would of course destroy some of the eggs, or seed, or even an animalcule, and the lime, by its corrosive quality, annihilate the remainder; but should any of the eggs, &c. remain on the corn animable, there may be here and there a burnt in the crop. But if, on the other hand, the insect should deposit its egg, eggs, or seed, in the earth, it is possible the brine, urine, and lime, wherewith the corn is as it were coated when sowed, may be unpleasing to the delicate taste of the little animal, and prevent its wounding the tubes of the plant.

Farther and more accurate experiments are still wanting to fully ascertain the nature of this disease, and the best modes of preventing it. See *Diseases of Plants* and *Smut.*

BURNET, the name of a plant that may probably be cultivated, in some cases, with advantage, as a green winter-food for different sorts of animals. A representation of this plant is given at *fig.* 11, *plate* III.

As the providing of a large supply of green food for live-stock, especially fattening sheep, ewes, and lambs, and milch cows, during the winter months, is an object of the greatest importance to the farmer, he should not neglect the culture of such plants as promise to be beneficial in this way: for as turnips, though well adapted to the purpose, cannot be preserved in severe winters, and clover, rye, and other grasses, cannot be ready sufficiently early; burnet, in such cases, should be attended to in this view. It is not, however, probably so agreeable a food for animals as that of some other plants, but from its standing severe winters without injury, and being an early plant, it may frequently be found highly useful.

It succeeds on almost any sorts of soil, but those

of a strong clayey nature, and may be sowed, like other seeds, with corn, and covered by means of a slight harrowing. The quantity of seed sown is commonly about a bushel to an acre.

According to Mr. Young, April "is a proper season for sowing burnet; but it may be sown in May with buck-wheat: and the best method of cultivating it is, to sow about a bushel per acre, with either barley or oats, and to cover it at two harrowings. It flourishes extremely well on most soils; but it yields a produce proportioned to the goodness of the land, though it will do on those which are very indifferent. The great use of it is for spring-feed for sheep. If left of a proper height in the autumn, it will improve through the winter, notwithstanding frost, and be ready early in the spring. This is a great excellency, in which it is rivalled by no other grass. Burnet does well, he says, mixed with ray-grass or cocks-foot: about three pecks of burnet, and one bushel of ray-grass, or cocks-foot, to the acre."

The author of the New Farmer's Calendar thinks it advantageous to mix burnet with ray-grass and white-clover, or with the latter alone, not only with the view of securing a good bottom, but to render the herbage more palatable to cattle in general, which he has been convinced, by ocular proof, have no great relish for burnet: they, however, become accustomed, he says, to its cucumber-flavour in time, and contented with it; no small inducement to which is, that they are commonly fed with it when no other grass is to be obtained. Of its salubrity there is, he thinks, no question, and even its medicinal virtues are confidently spoken of, particularly for sheep suspected of unsoundness. It is excellent winter-food for deer and rabbits. Several reasons are to be assigned for the ill success which has attended various attempts to cultivate this grass, as will appear in the following directions. Its chief use is as an early grass, and whilst young; and it must never be given to cattle when old and stalky, nor kept to that state when intended for hay. In fact, says he, burnet should always be reckoned out of season when other grasses can be had. It never ought to be fed but from January to the end of April; and upon lands proper for it, with judicious management, it will afford pasture even in January. It receives less injury from frost than any other herbage, and will even grow in the winter months, provided the weather be not too severe. If shut up in April, it will mow at midsummer, after which it must be reserved for feed until January or February; when, if the weather be favourable, it may be cut and carried to the stock, as in summer, and afterwards fed, but not too close with sheep, until the time of shutting up again. It will produce upwards of a ton of hay per acre, and may be mowed again for seed; but if driven so hard, of course will not produce so large a quantity of spring-seed as when mowed but once. The value of the seed upon an acre will be from five to ten pounds. Granting the truth of this account of burnet, continues he, it would be altogether superfluous to enlarge upon its value to a live-stock farmer; but such advantages will ever be looked for in vain upon a cold barren clay, or without the seed being fresh and good, or without culture and manure, even on a proper soil. One of the first objects is, to be sure the seed be good, which is seldom the case, burnet being a grass very little cultivated, and in which he has more than once been foiled in his endeavours to raise a crop from that circumstance. It may be advantageously cultivated in drills, and treated precisely like lucerne, a method which he has lately adopted. It may be sowed indifferently either in spring, summer, or autumn. It frequently happens that the crop is thin until the third year, but afterwards very luxuriant, fully covering the soil. It is further observed, that burnet is a native of this country, growing spontaneously in many parts, particularly, as he has heard, upon Salisbury Plain, whence he is of opinion an indication may be drawn of its proper soil: like lucerne, it defies drought in summer, which makes it valuable in another point of view. The seed has been warranted as good food for horses as corn—a consideration for those who may have the convenience of bruising it.

Mr. Young observes, that, in July, crops of this plant will be fit for mowing: the seed is apt, he says, to shed, if care is not taken in mowing it. It is best threshed in the field, like turnip or cole-seed, and the straw made into hay. It yields very great crops of seed; and some persons have asserted, that it is as good for horses as oats; but no satisfactory trials of due continuance have, he says, been made on it.

He inserts "the following notes from Doctor Templeman, as deserving attention; in which it is remarked by the writer, that his burnet, though very green and beautiful all the winter, made no great progress till the middle of April following, when he thought it absolutely necessary to feed it. He did so; but he did it too late, and kept his cattle upon it too long, from the middle of April to the 20th of May. This was a very great mistake: the burnet-plants were now headed for seed, and the stock fed chiefly upon the heads, which greatly lessened his quantity of seed, as well as retarded the growth of the plants. He turned ewes, lambs, and calves into the field, and they all fed very greedily upon the burnet. From what he had heard of Mr. Rocque, he very much expected them to scour; but there was not the least appearance of it, and the cattle throve accordingly.

The 6th of July he began to mow, the weather being favourable: six men and four boys threshed and cleared the seed in seven days. He had 200 bushels of very fine clean seed, as many sacks of chaff, and seven loads of hay, from a field of seven acres and a quarter. Satisfied that 200 bushels of seed would be more than he should be able to dispose of, he was not anxious after another crop, being rather desirous of seeing what it would perform as a pasture. Accordingly, in about ten or twelve days after the field was cleared, he turned seven cows,

two calves, and two horses into it; they all throve very remarkably, and the cows gave more, and we thought a richer milk than in any other pasture: he really expected, as burnet is so strong an aromatic, that the milk would have had a particular taste, but far otherwise, the milk, cream and butter were as fine, if not finer tasted than any from the best meadows. He is satisfied, that there is no better pasture for cows, whether milched or barren, than burnet. The weather was now extremely droughty; all our pastures, says he, were burnt up, yet the burnet flourished and grew away as if it had a shower every week. His stock of cows, horses, and calves, before-mentioned, pastured in it almost continually till Michaelmas: by the middle of November it was grown so considerably, that he has again turned in six head of cattle; and if the weather be not severe, he is of opinion, it will maintain them till Christmas."

It is added, that "the burnet-straw, or haulm, is, after the seed is separated from it, a very useful fodder for horses, cows, calves, and sheep: the chaff is of good value, if mixed with any other, however ordinary, chaff. He has fed all the above-mentioned stock with it promiscuously together in one field; putting the haulm into racks, and the chaff into troughs; and if the haulm was chopped with an engine, it would still be of much more value. Burnet, he is fully persuaded, will prove a very great acquisition to husbandry on many accounts, but more particularly for the following reasons: It is a good winter pasture, consequently it will be of great service to the farmer, as a constant crop he may depend upon, and that without any expense for seed or tillage, after the first sowing; whereas turnips are precarious and expensive, and when they fail, the farmer is very often put to great inconveniences to keep his stock. It affords both corn and hay. Burnet-seed is said to be as good as oats for horses. He knows they will eat it very well: judge then the value of an acre of land which gives you at two mowings ten quarters of corn, and three loads of hay. The seed indeed is too valuable to be put to that use at present; though it multiplies so fast, that he doubts not but in a few years the horses will be fed with it. It will bear pasturing with sheep. It makes good butter. It never blows or hoves cattle. It will flourish upon poor light, sandy, stony, shaltery, or chalky land. Burnet, after the first year, will weed itself, and be kept clean at little or no expense. And the cultivation of it is neither hazardous nor expensive: if the land be prepared, as is generally done for a crop of turnips, there is no danger of any miscarriage, and any person may be supplied with the best seed at 6*d.* per pound. He makes no doubt but that burnet might be sown late in the spring, with oats or barley. A gentleman in his neighbourhood did so last summer, and it succeeded very well. He should think a buck-wheat season, which is sown the last of all corn, would suit it very well; but of this he has no experience, and could wish to have the experiment tried. A pea-field, drilled in rows, and kept clean, would make an excellent season for burnet, as the pea-crop would come off soon enough to prepare the land with two ploughings by the middle of August; after which time he should not chuse to sow it. It very frequently happens, that every farmer who sows many acres with turnips, has several worth little or nothing: the fly, the black catterpillar, the dry weather, or some unknown cause, often defeating the industry and expense of the most skilful farmer. When this happens, as it too often does, he would by all means advise him to sow it with burnet, and in March and April following he will have a fine pasture for his sheep and lambs."

It is strongly advised by Mr. Young, "not to let any cattle pasture the burnet-fields after mowing, either for seed in July, or for a second crop of hay in August; for the greatest peculiarity of this plant is to afford a full bite in March; and, if you leave it six or eight inches high in October, you will find more the beginning of March, and in possession of the leaves it had in autumn; for the winter's frosts have not much effect on it. Upon this caution, therefore, says he, depends much of the advantage of burnet: some who have found fault with it, and asserted that it is unprofitable, have fed off the after-grass in autumn bare, and let their sheep and cattle get into it in winter. It is then no wonder the burnet does not answer the character given of it by others, who have managed in a different manner.

"An acre of it, managed properly, will at this season yield much more food than an acre of clover and ray-grass. It should be four or five inches high in November, and left so through the winter. Burnet has the singular quality of maintaining its green leaves through the winter: so that, under deep snows, you find some luxuriance of vegetation. From November to February, the crop will gain two or three inches in growth in the young leaves, and then be ready for sheep. It will be better in March, and if kept, ready in April not only for sheep, but for horses, cows, or any other stock."

In the twenty-first volume of the Annals of Agriculture, we have the following statement of the advantage derived from five roods of wet land, a strong tenacious loam, on a dry and clay-mixt bottom, eaten off by ewes and lambs in the beginning of April, besides the straw, which was carefully laid up for winter provision for sheep, in wet weather, and the chaff for horses with their corn, which are reckoned together with a week's keep of fifty sheep, just taken out, as tantamount to the expense of mowing, threshing, dressing, and carting.

		£.	s.	d.
Keep of 30 couples, for three weeks, at 6*d.* per week, - - - -		2	5	0
19 ditto, 10 days, at 4*d.* per week, - - - - - - - -		0	9	6
Value of seed, at 10*s.* per bushel, - -		13	0	0
Rent, at 15*s.* per acre,	£.0 18 9	15	14	6
Tythe and town charges,	0 7 3			
		1	6	0
		14	8	6

The land on which burnet is sown should always be made perfectly fine before the seed is put in.

BURROW, a provincial word, signifying a heap or hillock, hence stone-burrows, beat-burrows, &c.

BUR-TREE, a provincial name sometimes applied to the elder-tree. It is sometimes written *Bor-Tree*.

BUSH, a collection of shrubs or plants of the same or other kinds, growing close together, so as to form a sort of clump.

Bush, a provincial word, signifying the box of the nave of a wheel.

Bush-*Draining*, a term applied to that sort of draining, which is done by putting in, or filling the drains with bushes.

Bush-*Harrow*, an implement constituted of any sort of bushy wood, interwoven in a kind of frame, consisting of three or more cross-bars, fixed into two end-pieces in such a manner as to be very rough and brushy underneath. To the extremities of the frame before are generally attached two wheels, about twelve inches in diameter, upon which it moves; sometimes, however, wheels are not employed, but the whole rough surface is applied to, and dragged on, the ground. See *Harrow*.

Bush-*Harrowing*, the operation of harrowing with an instrument of the kind just described. It is chiefly necessary on grass-lands, or such as have been long in pasture, for the purpose of breaking down and reducing the lumps and clods of the manures that may have been applied, and thereby rendering them more capable of being washed into the ground, or for removing the worm-casts and mossy matter that may have formed on the surface.

BUSHEL, a measure of capacity for dry things, as grain, fruits, pulse, and many other articles, containing four pecks, eight gallons, or sixteen quarts, and is the eighth of a quarter.

The bushel, by a statute made in the twelfth year of Henry the Seventh, is to contain 2,178 cubic inches, or eight gallons of wheat; the gallon of wheat to weigh eight pounds troy-weight; the pound, twelve ounces troy-weight; the ounce, twenty sterlings; and the sterling, thirty-two grains.

Besides the standard or legal bushel, we have several local bushels, of different dimensions in different places. At Abingdon and Andover, a bushel contains nine gallons; at Appleby and Penrith, a bushel of peas, rye, and wheat, contains sixteen gallons; of barley, big, malt, mixt malt, and oats, twenty gallons. A bushel contains, at Carlisle, twenty-four gallons; at Chester, a bushel of wheat, rye, &c. contains thirty-two gallons, and of oats forty; at Dorchester, a bushel of malt and oats contains ten gallons; at Falmouth, the bushel of stricken coals is sixteen gallons; of other things twenty, and usually twenty-one gallons; at Kingston upon Thames, the bushel contains eight and a half; at Newbury, nine; at Wycomb and Reading, eight and three-fourths; at Stamford, sixteen gallons.

The French bushel consists of four quarters, and the quarter of four litrons, each containing thirty-six cubic inches. Consequently the bushel contains 576 French cubic inches, which, according to Mr. Greaves's calculation, is nearly equal to 615 English inches. The French bushel, therefore, is to the English, as 615 is to 2,171. That is, the French bushel contains one peck, a quart, and two cubic inches nearly. And the French bushel for oats is double that of any other kind of grain.

BUSH-VETCH, a plant of the vetch kind, which may probably be cultivated to advantage by the farmer, where lucerne and other plants of a similar nature cannot be grown. It is observed by Mr. Swayne, in the third volume of the Letters and Papers of the Bath Society, that its root is perennial, fibrous, and branching; the stalks many, some of them shooting immediately upwards, others creeping just under the surface of the ground, and emerging some near to, and others at a considerable distance from, the parent-stock. The small oval leaves are connected together by a mid-rib, with a tendril at the extremity; the flowers are in shape like those of the common vetch, of a reddish purple colour; the first that blossom usually come in pairs, afterwards to the number of four at a joint; the pods are much shorter than those of the common vetch, larger in proportion to their length, and flatter, and are of a black colour when ripe; the seeds are smaller than those of the cultivated species, some speckled, others of a clay colour. Being a perennial plant, it should seem, he thinks, to be a very proper kind to intermix with grass-seeds for laying down lands intended for pasture; and that it is as justly entitled to this epithet as any herbaceous plant whatever, having observed a patch of it growing in one particular spot of his orchard for fourteen or fifteen years past. It is not only a perennial, but an evergreen; it shoots the earliest in the spring of any plant eaten by cattle with which he is acquainted, vegetates late in autumn, and continues green through the winter, though the weather be very severe; add to this, that cattle are remarkably fond of it. These peculiarities should make it particularly valuable to the farmer as a green food for sheep in the winter and spring, when food of that denomination is so exceedingly scarce.

The chief reason which has hitherto prevented its cultivation, has been the very great difficulty of procuring good seed in any quantity. The pods, he finds, do not ripen altogether; but as soon almost as they are ripe, they burst with great elasticity, and scatter the seeds around; and after the seeds have been procured, scarce one-third part of them will vegetate, owing, as he supposes, to an internal defect, occasioned by certain insects making them the nests and food for their young.

It seems, from the author's account also, that a crop of this kind of vetch may be cut three or four times, and in some cases even so early as the beginning of March—a circumstance of much importance to such farmers as have a large stock of cattle.

In his trials with this plant, cut in this way, a plat of good stiffish loamy land, of twenty-five square yards, produced,

	lb.			lb.	
1st cutting	16	green	supposed	4	dry
2d do.	130	do.	would have weighed	$21\frac{1}{2}$	dry
3d do.	62	do.	would have weighed	14	dry
4th do.	$76\frac{1}{2}$	do.	would have weighed	$12\frac{1}{2}$	dry
Total	$284\frac{1}{2}$	green		52	dry

An acre, therefore, says he, reckoning 4840 square yards to it, in the same circumstances, would have produced the total amount of

Tons.	cwt.	qrs.	lb.	
24	11	3	3	green
4	9	3	15	dry fodder.

It is further observed, that at the time the first cutting was made, there was scarce a green blade of grass to be seen; and that the season, till after the third cutting, was unfavourable to vegetation as perhaps any in the memory of man.

BUSK, a term provincially applied to a bush.

BUSS, a term provincially applied to a grass-calf.

BUTT, a provincial term applied to such ridges or portions of arable land, as run out short at the sides or other parts of fields.

Butt, a provincial word applied to a close-bodied cart; hence, a *dung-butt* or wheel cart, *gurry-butt* or sledge cart, *ox-butt*, *horse-butt*, &c.

Butt-*Load*, a provincial word applied to a load of six seams.

Butt *of a Tree*, that part of the tree to which the root is attached. It is also sometimes applied to the lower part of the stem.

BUTTER, a fat unctuous substance, prepared from milk by the agitation of beating or churning. This fat oily matter is naturally distributed through all the substance of the milk in very small particles, which are interposed betwixt the caseous and serous parts, amongst which it is suspended by a slight adhesion, but without being dissolved. It is in the same state in which oil is in emulsions: hence, the same whiteness of milk and emulsions; and hence, by rest, the oily parts separate from both these liquors to the surface, and form a cream. When butter is in the state of cream, its proper oily parts are not yet sufficiently concentrated to form an homogeneous mass. Whilst separated by the interposition of a large quantity of serous particles, the butter cannot be completely formed; but by pressing out these heterogeneous parts by means of continued percussion by the well-known operation of churning, it then becomes an uniform soft mass.

In the management of the milk, after it is drawn from the cow until the butter be extracted, there are many circumstances that require to be attended to. In the best conducted butter-dairies, Mr. Donaldson says, the methods of proceeding are these: when the milking of the cows is completed, which is usually effected by six o'clock in the morning, and before seven in the evening (but in some places in England as well as in Scotland, it is common to milk cows three times a day during the grass-season—in the morning, at mid-day, and in the evening), the milk is strained through a hair search or sieve, or, what is better, a large wooden bowl, with a hole at the bottom, covered with a close sieve of fine silver or other wire, into large square shallow cisterns, covered with lead, or earthen pans made of but little depth, or into wooden vessels, which in Scotland are called *cogs*, and in Gloucestershire and some other places in England *skeels*, where it remains for some time, according to the state of the weather and other circumstances. It is commonly set to the depth of five or six inches when put in the *cogs*; but when leads, cisterns, or pans, are used, which is generally the case in the southern parts of the kingdom, from two or three inches is the usual depth. Setting out milk in large shallow cisterns is certainly much perferable to the other method, as a greater quantity of cream is not only by that means obtained, but it is also found from experience, particularly in Cheshire, that the expeditious cooling of the milk has considerable influence in preventing its tendency to acidity in warm weather. At the same time it ought to be observed, that, while the method followed in the southern districts of the island is in this respect preferable to that adopted in the more northern ones, the practice of using lead for covering these cisterns or coolers is certainly improper and dangerous, as, although these lead coverings may be kept very clean, by rubbing or scouring them with salt, sea-sand, &c. yet nothing can prevent a certain portion, at least, of the poisonous quality of the lead from affecting the milk, especially if it be allowed to remain in the cisterns for any length of time. As soon as the pans or leads are filled, they must be placed on the shelves in the milk-house, where they remain undisturbed till it is proper to separate the cream from the milk.

Dr. Anderson observes, that the length of time that should elapse before the cream be separated will depend upon the degree of heat at the time, and the particular views of the owner of the dairy. In a moderately warm temperature of the air, if very fine butter be intended, it should not be allowed to stand more than six or eight hours. For ordinary good butter, it may safely be let stand twelve hours or more; but where the dairy is so large as to afford a sufficient quantity of cream, and where the very best butter is intended (the milk being to be converted to some other use while yet sweet), it may be separated after standing only two, three, or four hours. Milk, in the general management of dairies, is never skimmed more than once. In the county of Essex, as well as some others, it is, however, the common practice to skim it three or four times, or till no more cream rise. In the business of separating the cream from the milk, there are two methods pursued; that most generally practised is to skim it off with a skimming dish, made either of tin or of wood. The other is adopted only where leads or cisterns are common, and where the milk is used for making skim-milk or two-meal cheeses; and, of course, before it coagulate, or acquire any degree of acidity. Towards the centre of the cistern there is a hole or pipe, which, before the milk be put in, is shut with a wooden

stopper that rises several inches above the surface of the milk. When the milk is wanted for any of the purposes above-mentioned, a vessel is placed under the pipe, and the stopper drawn up so far as to allow the milk to run off, but so gently, as that the surface of the cream may not be broken. The milk being thus gradually drained off, the cream sinks down, till it at last rests on the cistern, when the vessel containing the milk being removed, and another placed for the purpose of receiving the cream, the stopper is entirely drawn out, and the cream drops into the vessel.

The first of these, according to the above author, requires a dexterity of manipulation, that can be acquired by practice alone; but it is of great importance to the success of the dairy, that it be well done; for, if any part of the cream be left, the quantity of butter will be diminished; and if any part of the milk be taken, its quantity will be debased.

The cream, when thus separated from the milk, ought to be immediately put into a vessel by itself, there to be kept till a proper quantity be collected for being made into butter: and no vessel can be better adapted for that purpose than a firm neat-made wooden barrel, in size proportioned to the extent of the dairy, open at one end, with a lid exactly fitted to close it. In the under part of this vessel, close to the bottom, should be placed a cock or spigot, for drawing off from time to time any thin serous part of the milk that may chance to be there generated; for, should this be allowed to remain, it acts upon the cream in a powerful manner, and greatly diminishes the richness of the quality of the butter. The inside of the opening of the barrel should be covered with a bit of close fine wire or silver gauze netting, to keep back the cream, while the serum is allowed to pass: and the barrel on its stand should be inclined a little forward in the top, to allow the whole to run off.

It is difficult to state, Mr. Donaldson says, any particular period for its being kept in these reservoirs before churning, so different is the management in this particular in different places. About Epping, in Essex, which has been long in high repute for the superior quality of its butter, the cream is seldom kept above three or, at farthest, four days. It was the practice in a large dairy in Suffolk, which he was led to visit some years ago, on account of the high character it had obtained for making butter of a superior quality, when the butter was to be sent directly to market, to churn the cream the second or third day: but when it was to be salted, to keep it a day or two longer, or till it had acquired a certain degree of acidity. The dairy-woman, who had had a long and extensive experience, accounted for her conduct in this respect, by observing, that butter made from fresh cream was much better and pleasanter to the taste, but that it would not take in the salt so well, nor keep so long, as that made from cream that had been longer kept.

Many persons, says Doctor Anderson, who have had little experience in the dairy, believe that no butter can be of the finest quality, except that which has been made from cream that has not been kept above one day; but this is a very great mistake. So far indeed is this opinion from being well founded, that it is in very few cases that even tolerably good butter can be obtained from cream that is not more than one day old. The separation of butter from cream only takes place after the cream has attained a certain degree of acidity. If it be agitated before that acidity has begun to take place, no butter can be obtained, and the agitation must be continued till the time that sourness is produced, after which the butter begins to form. In summer, while the climature is warm, the beating may be, without very much difficulty, continued until the acidity be produced, so that butter may be got; but in this case the process is long and tedious, and the butter is, for the most part, of a soft consistence, and tough and gluey to the touch. If this process be attempted during the cold weather in winter, butter can scarcely be in any way obtained, unless by the application of some great degree of heat, which sometimes assists in producing a very inferior kind of butter, that is white, hard, and brittle, with very little taste, and almost unfit for any culinary purpose whatever. The judicious farmer, therefore, says he, will not attempt to imitate this practice, but will allow his cream to remain in the vessel appropriated for keeping it, until it has acquired that proper degree of acidity that fits it for being made into butter with great ease, by a very moderate degree of agitation, and by which process only very fine butter ever can be obtained.

How long cream ought to be kept before it attains the precise degree of acidity that is necessary to form the very best butter, and how long it may be kept after that period before its quality be sensibly diminished, has never yet, he presumes, been ascertained by any experiments that can be relied on. So little nicety has been observed in this respect by practical farmers, even those who have a high reputation for making good butter, that few of them ever think of observing any precise rule in this respect with regard to the different portions of their cream, seeing they in general make into butter all the cream they have collected since the former churning, so that the new and the old is all beaten up together; and he can find nothing like an uniform rule established among them as to the time that should intervene between one churning and another, that being usually determined by local or accidental circumstances. He is himself inclined to believe, that if the cream be carefully kept, and no serous matter allowed to lodge about it, a very great latitude may safely be admitted in this respect. How long cream may be thus kept in this climate, without rendering the butter made from it of a bad quality, he cannot say; but he can say with certainty, that it may be kept good for a much longer time than is in general suspected, even a great many weeks. It is however certain, that cream which has been kept three or four days in

summer, is in excellent condition for being made into butter; and he is inclined to believe, that from three days to seven may be found in general to be the best time for keeping cream before churning; though, if circumstances make it necessary, a considerable latitude in this respect may be allowed.

If, however, continues he, it should chance that any farmer has such a quantity of cream as might be worth his while to churn once every day, there is nothing to prevent him from doing it. He has only to provide a separate vessel for holding the cream for each day he means it should stand before churning; if three days, three vessels; if four days, four vessels, and so on. Thus he might churn every day cream of three days old, or of four, or any other number of days old, that he might incline. In the same manner, if it were found that the cream of two, of three, or of a greater number of days gathering, was required to make a proper churning, it might be easy so to contrive it as to churn every day, as will be obvious to any one who thinks upon the subject. In this way the operations of a dairy may be kept perfectly regular and easy. Some persons choose to churn the whole of the milk without separating any part of the cream. In this way they obtain a greater quantity of butter, though of an inferior quality. By careful management, however, especially if a portion of the first-drawn milk be separated, very good butter may be obtained; but he thinks the practice, on many accounts, is not to be recommended.

During summer, or while the cows are fed on grass, no art is requisite to give butter that colour which is agreeable to the purchaser or the consumer; but, in the winter and spring months, the dairy people find it necessary, in order to please their customers, to alter that tallowy colour which is natural to butter in these seasons. This is done by means of a little arnetta, which, after being pounded, or otherwise reduced to as fine a powder as possible, is mixed with the cream before it be put into the churn, and in such quantities as, from experience, has been found necessary for giving the desired colour.

It is then to be put into the churn of the kind which is preferred, as there are several different sorts employed in different places, and agitated for some time, in order to effect the separation of the butter. From the practice generally adopted in the best managed dairies of cooling the churn, by filling it for some time with cold water before churning in summer, and of warming it with scalding water when the weather is very cold in winter; and of putting in also cold or hot water among the cream in the churn occasionally, according to the season of the year, it is obvious, says Mr. Donaldson, that cream possessing a proper temperature, whatever that temperature may be, is, among the most exact dairy people, considered essentially necessary in the making of good butter; which being admitted, it must follow, some churns may be better suited to the purpose than others—as such as admit a free supply of atmospheric air, and permit that which, from the violent agitation, has become overheated, to escape, from their preserving that medium temperature which, it would appear, cream, in the course of making into butter, ought to possess, than such as are kept constantly shut up, or in which the air is only allowed to enter or escape occasionally, by means of a small aperture.

And, in the process of churning, much greater nicety, says Dr. Anderson, is required than most persons seem to be aware of. A few hasty irregular strokes may render the whole of the butter of scarcely any value, that, but for this circumstance, would have been of the finest quality. The owner of an extensive dairy, therefore, should be extremely attentive to this circumstance, and should be at great pains to procure a proper person for managing this branch of business. This person ought to be of a cool phlegmatic temper, sedate disposition and character, and ought never to allow another person, especially those who are young, to touch the churn, without the greatest caution and circumspection. Those who have been used to see cream churned that has not been properly prepared, will think, perhaps, that this would be severe labour in a large dairy for one person; but nothing is more easy, as to the bodily labour it requires, than the process of butter-making, where the cream has been duly prepared.

When, by the operation of churning, or keeping the cream constantly in motion, the butyraceous particles are separated from the milk, and united to each other, the butter is taken out of the churn, and put into a large wooden bowl, *skeel*, or *cog*, along with some cold spring-water, where it can be procured.

After which the dairy-maid, by kneading it with her hands, or, what is better, a wooden spoon or sort of spatula, with a short handle, and afterwards breaking it into as minute divisions as possible, and by rolling and pressing it against the bottom and sides of the vessel, expresses and forces out any milk that it may contain. When it has thus been well worked, the milky water is poured out, and an additional quantity of pure clean water put in; and the operations of kneading, breaking, and pressing, are again renewed, and continued till the water at last appears scarcely tinged with milk, which is the only proper criterion by which to determine when the butter has been sufficiently worked.

A considerable degree of strength, as well as of dexterity, says Dr. Anderson, is required in this manipulation. The thing wanted is to force out the milk entirely, with as little tawing of the butter as possible; for, if the milk be not entirely taken away, the butter will infallibly spoil in a short time; and if it be much worked, the butter will become tough and gluey, which greatly debases its quality. The butter is in some places beaten up by the hand, which he considers as an indelicate and barbarous practice.

The employing cold water in this operation, poured upon the butter in order to wash it, is a practice, he says, not only useless, as the butter can be perfectly cleared of the milk without it, but also pernicious,

because the quality of the butter is thus debased in an astonishing degree. Nothing is so hurtful in a dairy as water improperly used, which, if mixed in any way with either milk or butter, tends greatly to debase the quality of the last.

In most cases, a small quantity of salt is mixed with butter which is intended for immediate use; and when butter is salted, whether it be with a view to keeping, or for immediate sale, the salt is applied as soon as the milk has been extracted or removed in the manner just described. Part of the butter is spread on the bottom of another bason or *skeel*, which has been previously washed and prepared for the purpose; and a quantity of salt being strewed over it, an additional layer of butter is then laid on; over this another sprinkling of salt, and so on alternately till the whole be salted to the proper degree, according to the use for which the butter is intended. When the whole is thus salted, the dairy-maid again kneads, breaks, and works it in such a manner as to make the salt mix intimately with it; and when she thinks she has fully effected this purpose, she pours some spring or other cold water over the whole; and, by again working the butter, washes it free from the brine, and from any milky substance, which, by the salting, and the repetition of kneading, pressing, &c. may have been expressed.

Dr. Anderson says, that when the butter is entirely freed from the milk, if it is to be sold sweet, it may be made up into any form that is most generally liked at the market where it is to be sold. If the heat should be so great as to render it too soft to receive the impression of the mould, it may be put into small vessels, which may be allowed to swim in the trough of cold water under the table, but without allowing any of that water to touch the butter: there it will in a short time acquire the necessary degree of firmness, especially if a little bit of ice has been put into the bason, after which it may be taken out and moulded into proper form. It should then be put down, in proper dishes, upon the stone border that surrounds the trough, where it may be kept cool and firm till it be packed up to go to market.

In every part of the foregoing process, says he, it is of the utmost importance that the vessels and every thing else about the dairy be kept perfectly clean and sweet, for without this precaution there neither can be pleasure nor profit derived from it.

These operations of butter-making being thus performed, all that remains is, to weigh and make it up in the form in which in that particular district it is most saleable. In some places it is weighed in pounds, containing from sixteen to twenty-eight ounces, according to what is rated a pound of butter in the market where it is to be sold. In others it is made up partly into pounds, and partly into half pounds, so as to suit the convenience or taste of the purchasers. The usual form in which it is exposed to sale is in rolls; but it is sometimes made into circular cakes of about three or four inches diameter, and about an inch thick, and on the top of which some figures are impressed, by means of a wooden print carved for the purpose. When the butter, in well-managed dairies at least, is weighed and made up for market, it is usually placed in cold water till the period for sending it to market arrives. When that happens, in those districts where cleanliness is attended to, every print or roll is packed in the large green leaves of the garden orach, a plant frequently cultivated for the purpose, or in those of kidney-beans, &c. The method used in packing butter for market in the vale of Gloucester, is in most respects superior to what is common in other places, and which Mr. Marshall describes in the following manner: "In packing a butter-basket, the bottom is bedded with a thick cloth folded two or three times; on this is spread a fine thin gauze-like cloth, which has been dipped in cold water; and on this is placed the prints, with a large leaf beneath, and a smaller upon the centre of each. The bottom tier adjusted, a fold of the cloth is spread over it, and another tier set in a similar manner. At market the cloth is removed, and the prints, partially covered with leaves, are useful, as well as pleasing to the eye. They serve as guards to the prints. The butter is taken out of the basket as well as put into it without being touched, or the prints disfigured." When butter is salted with a view of disposing of it as salt-butter, it is commonly put into small casks called firkins, containing 56*lb.* each, and sold in autumn to the butter-factors or cheesemongers in the large cities or towns.

The quantity of butter produced from a given quantity of milk, depends on a variety of particulars; as the quality of the milk, the age and quality of the pastures on which the cows are maintained, and whether the milk is allowed to stand a sufficient time to throw up the whole cream which it contains. But, on a medium, four gallons of milk will produce sixteen ounces of butter; and the quantity which a dairy of cows of any magnitude, in regard to numbers, may be supposed to yield, may be rated at six pounds each per week in summer, and from four to five in winter, according to the manner of feeding them.

Another method of making butter is followed in Devonshire and Cornwall. They there put the milk into pans, either made of copper tinned, or of brass, or into brown earthern vessels glazed, which they place on a stove, gently heated with charcoal, and scald it until the cream be raised to the surface by the operation of the heat. When it has continued on the stove a certain time, which the dairy-maid judges of by practice, bringing it as near to boiling as possible without doing so, it is then set to cool. Twelve hours are sufficient for it to stand in winter, although it generally remains from four o'clock in the afternoon to seven the next morning. Sixteen hours are customary in summer. The cream is then taken off, and it is worked up by the hand, without any churn, into butter. The operation is performed by the dairymaid's turning the cream round with her hand in a circular motion, always moving it in one direction, which unites the particles together. In this mode of management, cleanliness is to be particularly attended to by the dairy-maid.

In Holland, the method of making butter, accord-

ing to the account of Mr. Carew, as stated in the Agricultural Report of Middlesex, is this:—After milking the cows, the milk is not put into pans till it is quite cold. It is then stirred two or three times a day with a wooden spoon, to prevent the cream from separating from the milk; and if it can be stirred till the spoon will almost stand in it, it is deemed so much the better. When it is found to be sufficiently thick, it is put into the churn, and beat for an hour. When the butter begins to form, a pint or more of cold water, according to the quantity of the milk, is poured in, to separate the butter from the milk. When the butter is taken out of the churn, it is washed and kneaded till the last water is perfectly clear and free from milk. By this method it is supposed that a greater quantity of butter is made from an equal quantity of milk. And the butter is said to be firmer and sweeter, and to keep longer, than that which is made in the ordinary mode which is in use in England. The butter-milk is also thought preferable.

Dr. Anderson thinks that wooden vessels are, upon the whole, most proper to be employed for containing salted butter. These should be made of cooper-work, very firm, and tightly joined with strong wooden hoops. It will be necessary to make them very strong where circumstances permit them to be returned to the dairy; for, as it is a matter of considerable difficulty to season new vessels so well as that they shall not affect the taste of the butter, it is always advisable to employ the old vessels rather than make new ones, as long as they continue firm and sound. Oak is the best wood for the bottom, and staves and broad Dutch split hoops are to be preferred to all others, where they can be had. Iron hoops should be rejected, as the rust from them will in time sink through the wood, though it be very thick, and injure the colour of the butter: one iron hoop, however, he says, should be put at the top, and another below beyond the bottom, the projection below the bottom being made deep for this purpose. No form is more convenient than that of a barrel, unless, perhaps, it be that of a truncated cone, with the apex uppermost; as in this case the butter never can rise from the bottom, and float upon the brine, which it will sometimes do in the under part of a barrel when brine is necessary. But this inconvenience may be easily obviated by driving a wooden peg with any kind of a head into the bottom before it be filled, as the butter closely embracing that head all round will be kept perfectly firm in its place. An old vessel may be prepared for again receiving butter, by the ordinary process of scalding, rinsing, and drying; but to season a new vessel requires greater care. This is to be done by filling it frequently with scalding water, allowing it to remain till it slowly cools. If hay, or other sweet vegetables, are put into it along with the water, it is sometimes thought to facilitate the process. But, in all cases, frequent affusions of hot water are very necessary, and a considerable time is required before they can be rendered fit for use. The careful dairy-manager ought to be particularly guarded in respect to this particular, as otherwise the character of his dairy may soon be lost. The vessel into which it is to be put, after being rendered as clean and sweet as possible, should, he observes, be rubbed all over in the inside with common salt, and a little melted butter be run into the cavity between the bottom and the sides at their joining all round, so as to fill it, and make it every where flush with the bottom and sides.

Common salt has hitherto been almost the only substance employed for the purpose of preserving butter; but the doctor has found, by experience, that the following composition is, in many respects, preferable to it, as it not only preserves the butter more effectually from any taint of rancidity, but also makes it look better, and taste sweeter, richer, and more marrowy, than if the same butter had been cured with common salt alone. He has frequently made comparative trials with the same butter, and always found the difference much greater than could be well conceived:

Take of sugar one part, of nitre one part, and of the best Spanish great salt, or of Doctor Swediar's best salt, which is still better than the former, being cleaner, two parts. Beat the whole into a fine powder, mix them well together, and put them by for use.

This is a salt made, at Prestonpans, near Edinburgh, which they sell, after the Dutch method, by the name of salt upon salt; it is equally strong with the best Spanish salt, and much freer from impurities of every sort, and may be purchased as above at a moderate price.

One ounce of this composition should be put to every sixteen ounces of butter, and the salt be thoroughly mixed with the butter as soon as it has been freed from the milk, and without loss of time put down into the vessel prepared to receive it, pressing it so close as to leave no air-holes, or any kind of cavities within it. Smooth the surface; and if it be expected that it will be above a day or two before more can be added, cover it close up with a piece of clean linen, and above that a piece of wetted parchment, or, for want of that, fine linen that has been dipped in melted butter, that is exactly fitted to the edges of the vessel all round, so as to exclude the air as much as possible, without the assistance of any watery brine: when more butter is to be added, these coverings are to be taken off, and the butter applied close above the former, pressing it down and smoothing it as before, and so on till the vessel be full. When it is quite full, the two covers should be spread over it with the greatest care, and a little melted butter be poured all round the edges, so as to fill up every cranny, and effectually exclude the air. A little salt may then be strewed over the whole, and the cover be firmly fixed down to remain close shut till it be opened for use. If all this be carefully done, he thinks the butter may be kept perfectly sound in this climate for many years. How many years, he cannot say; but he has seen it two years old, and in every respect as sweet and sound as when it was only a month old. It deserves, he says,

to be remarked, that butter cured in this manner does not taste well till it has stood at least a fortnight after being salted; but that after that period is elapsed, it eats with a rich marrowy taste, that no other butter ever acquires; and it tastes so little of salt, that a person who had been accustomed to eat butter cured with common salt only, would not imagine it had got one-fourth part of the salt that would be necessary to preserve it.

But after this butter has been cured in the most perfect manner, it may chance to be much debased in its quality by being improperly treated during the time it is using. Therefore, when it is broken up for use, a small portion should be pared from the surface all over, especially near the edges, in case the air should not have been so entirely excluded as it ought to have been. If it be to be quickly consumed, it may then be spooned up as it is wanted, without any other precaution than that of keeping it carefully covered up so as to exclude dust, &c. from having access to it. But if it be to be used very slowly, and if the person to be employed in spooning it up be not very careful, or so indolent as not to be at the trouble of closing it up at each time with the covers, it may happen that the part which is thus long exposed to the air may contract a small degree of rancidity. To guard against this evil, in these circumstances, when the vessel is opened, let a strong brine of common salt be prepared that will swim an egg, and poured, when cold, upon the surface of the butter; this will cover that surface effectually, even though the operator should be a little careless, and will thus guard against the inconvenience complained of: for though the quality of the butter will thus be injured in some degree, in consequence of the water acting upon it, yet that is an evil of far less material moment than the slightest degree of rancidity would occasion.

Butter thus cured would, he observes, bear to be carried to the East or the West Indies, and would keep sweet during the longest voyages, if it were so packed as not to allow it to be so far melted as to occasion the salts to separate from it. But as none of these salts admit of any chemical union with the butter, it must happen, that if ever the butter be so far melted as to become of a fluid consistence, the salts must drop to the bottom, and the butter, deprived of their antiseptic powers, quickly becomes rancid. It would, he observes, be a great improvement in the culinary art, if any antiseptic substance could be found that possessed an agreeable taste and flavour, which was capable of being dissolved in oily substances.

In this view it is remarked, that butter, in its natural state, contains a considerable proportion of mucous matter, which is more highly putrescible than the pure oily parts of it. Where it is therefore intended that it should be exposed to the heat of warm climates, it ought to be freed from that mucilage before it be cured and packed for keeping. To prepare it for a distant voyage, therefore, in warm climates, it should be put into a vessel of a proper shape, which should be immersed into another containing water. The water should then be gradually heated till the butter be thoroughly melted; continuing in that state for some time, to allow it to settle, the mucous part will fall entirely to the bottom, and the pure oil swim at top, perfectly transparent while hot; but when it cools, it becomes opaque, assumes a colour somewhat paler than the original butter before it was melted, and a firmer consistence, more nearly resembling that of tallow, and consequently it will better resist the heat of a warm climate than butter itself. When this refined butter is become a little stiff, and while it is still somewhat soft, the pure part should be separated from the dregs, and then salted, and packed up in the same way as is directed for butter. This would retain the salt longer, and keep much longer sweet in hot climates, than if it had been cured in its original state.

This refined butter may, he further remarks, be preserved in yet another way, which he has sometimes seen practised here by way of medicinal *bonne bouche* (comfit). After the butter is purified, a certain proportion of firm honey is added to it, and mixed well; it will incorporate thoroughly with the butter, and when cold eats very pleasantly, spread on bread like butter; and may be given to old people, if they relish it, instead of marrow, and to others, as being useful for coughs and colds. These are the uses to which he has seen this substance applied, and on these occasions the proportion of honey employed was considerable. He has seen it kept for years, without manifesting the smallest tendency to rancidity, so that he thinks there can be no doubt but that butter might thus be preserved in long voyages without spoiling. The only point that remains to be ascertained is, what is the smallest proportion of honey that would be sufficient to preserve the butter. Sugar is known to be a much more powerful antiseptic than common salt, and probably honey may be in that respect nearly on a par with sugar. If so, it would be reasonable to suppose that one ounce of honey might be sufficient to preserve sixteen ounces of butter. In that case, the taste of the honey would not be extremely perceptible, so that the butter, even to those who might not relish the sweet composition above-mentioned, might prove very agreeable, especially if a little salt were mixed with it when about to be used. A few experiments would be sufficient to ascertain this particular. From the circumstance of the honey incorporating with the butter, and not separating from it while in a fluid state, it would promise, he says, nearly to accomplish the purpose wanted above. But whether, when it became very fluid, and was long continued in that state, any separation would take place, or whether the honey in these circumstances would be in danger of fermenting, are questions that experience alone can determine. Sugar, though it would preserve the butter equally well while it continued in a solid state, would doubtless separate from it when it became fluid.

Whey-Butter, an inferior sort of butter made from whey in dairies, where the principal object is cheese.

Mr. Donaldson remarks, that the practice of making butter from whey is a branch of dairy-management, the particulars of which are both curious and interesting, as, though it is adopted to a great extent in particular districts, it is by no means generally established. In Derbyshire more butter, he says, is made from whey than from the cream of milk, or from milk churned altogether.

Among dairy people whey is distinguished by the two different names of green and white, the former escaping readily from the curd, while the latter is forced from it by means of pressure. There are different methods of extracting the cream from whey. In some dairies, he observes, the whole whey, when taken from the cheese-tub, is put into skeels or other vessels, where it remains about twenty-four hours, when it is creamed, and the whey applied to the use of the calves and pigs, the latter of which are said to thrive as well on it, after the latter has been taken from it, as before. And the cream, when skimmed off the whey, is put into a brass pan and boiled, and afterwards set in pans or jars, where it remains till a sufficient quantity for a churning be procured, which in large dairies happens generally once, but sometimes twice, in the week.

The more common mode of management is, however, considerably different from this. The green whey is put almost immediately from the cheese-tub into the furnace-pan, where it is scalded. When it acquires the proper degree of scalding-heat, cold water, or some white whey, is occasionally put in; this causes the whey to break, and throw up a thick white sort of scum, somewhat resembling cream, which the dairy-maid keeps constantly skimming off as it rises, and which she puts into cream-jugs or jars, where it remains till the usual time of churning. In the dairies where the green whey is scalded, the runnings, except a little that is kept for the purpose of forcing the green whey, when scalding, to throw up the cream, are usually set in skeels or jars, in the same manner as the milk from the cows, and the cream, when taken off, being added to that procured by scalding, is churned in the ordinary way.

In two experiments made for the purpose of ascertaining the nature of making butter from whey, Mr. Robertson found the result the same, though the process was differently conducted. In one, the whey had stood twenty-four hours after being taken from the curd before it was put to the fire; but in the other, it was put on quite warm and fresh immediately from the curd; the quality as well as quantity being alike in both these methods.

The quantity of butter procured from whey is considerable; in two instances, where particular attention was bestowed to ascertain the fact, not less than about an ounce and a half from the gallon. In regard to the quality, it is unquestionably inferior to that of butter made from the cream of milk, or from the milk and cream churned together, but not so much so as stated by Mr. Marshall, in his Rural Economy of Gloucestershire, which is one-third. In the Report of the County of Leicester, it is indeed observed, that whey-butter sells for 9*d.* per pound, when other butter sells from 10*d.* to 11*d.* and also, that "eighteen cows will make about 17*lbs.* (16*oz.* each) of whey-butter per week," which is a circumstance that certainly merits the attention of those who are in the practice of making either one-meal or two-meal cheeses. See *Dairying.*

Butter-*Leaves*, a provincial word applied in some districts, to the leaves employed in packing butter for being sent to the market. See *Butter.*

Butter-*Milk*, the milk which is left after the butter has been separated by means of churning or other processes.

In some places this sort of milk is either sold to the poor, or made use of by the farm-servants. But, in large dairies, it is most frequently employed as a food for hogs, and in moistening the bran which is given to the poultry in the farm-yard.

BUTTER-BUR, the name of a weed resembling in some respects colt's-foot, but the flowers are purple, and grow in a thyrse. The leaves come out after the flowers decay, and are like those of colt's-foot in shape, but three or four times as large. It infests damp meadows and pasture-grounds, and frequently proves a very troublesome weed. See *Colt's-foot.*

BUTTERFLY, the common name of a numerous and well-known class of insects, frequently prejudicial to grain crops.

It is remarked by the author of Phytologia, that as the eggs of butterflies are in the autumn wisely deposited in situations where the young can find proper food when they are hatched, by the warmth of the spring, those on apple-trees, and on gooseberry-trees, are frequently deposited on the leaves, as well as on other parts of the tree; and as these leaves fall on the ground, the eggs are thus covered and protected from the frosts, and the young caterpillars are believed to climb the trees in search of their food. If this be true, says he, it would be an advantageous practice to rake together the leaves in orchards, and to burn them, which some have done, from an idea that the smoke thus produced was noxious to the eggs of insects deposited on the branches. Some gardeners, he observes, for this purpose, rear their gooseberry-trees on one stem only; and believe, that by tying a fringe round this stem, the insects which are hatched in the soil, if such there be, cannot climb up the tree thus surrounded with a fringe; and as those caterpillars, which are already on the tree, let themselves down by a thread, when the tree is shaken, from the fear of being hurt by the vibrating twigs, if this thread be then broken, by moving a stick round under the tree, these insects cannot re-ascend. A paper recently tarred on the outside might, he thinks, be wrapped round the stem of the tree, instead of the fringe, with, perhaps, more certain success; but the tar should not be smeared on the bark of the tree, lest it should injure or destroy it.

He also says, the white butterflies, which deposit

their eggs on cabbage-plants, are seen flying about awkwardly in summer, and should be caught and destroyed by the gardener. Or they, perhaps, might be invited and poisoned by a mixture of honey-water and arsenic, as a wealthy man, in Italy, is said to have poisoned his neighbour's bees. These cabbage-caterpillars would, he thinks, increase in destructive numbers, but are half of them annually destroyed by a small ichneumon fly, which deposits its own eggs in their backs, which are there hatched by the warmth of the animal, and live on the silk there secreted for its future nest; and eroding their way out, spin small cacoons of their own, ten or twelve of which hang on each caterpillar, which thus perishes instead of changing into a butterfly. This he saw happen to a great many of them which were put into a box on bran, with a few cabbage-leaves, and covered with gauze, a few days before they were ready to change into chrysalises. This ichneumon fly should, therefore, be encouraged, if his winter habitation could be discovered.—See *Caterpillar.*

Corn-BUTTERFLY, an insect which is said to commit great ravages on grain in its vermicular state.

It is observed, in a paper on the subject, published in France, that butterflies of this kind have much resemblance to the common and false moths, except in being somewhat longer and larger shaped; and that they are of the class of four-winged *phalenæ* or night butterflies—their wings being long in proportion to their breadth, which is almost equal at the upper and the lower end. The colour of the upper wings varies, being sometimes of a light, and sometimes a darkish grey brown, but always shining when exposed to the sun. The position of these wings, of which the edges are close set with long hairs, is horizontal when the insect first settles after having flown; but soon after those edges incline downward. Its head is furnished with two antennæ, the joints of which, nicely fitted into each other, lessen gradually up to the point. The eyes are almost as large as those of the false moth. Between the antennæ are two beards, which proceed from the lower part of the head, and rise up above it, in the middle between which is a tuft of hairs, which turn up backward.

It is remarked, that these insects do not take any food while they are in the state of butterflies; nor prey upon and destroy corn during that period, as is the general opinion, not having organs capable of doing it the least injury; their only function being the procreation of their species.

As soon as the female is impregnated, she lays eggs in great numbers, which are deposited sometimes on one spot and then on another, but mostly about the place where the grain is fixed to the stalk, in heaps of 60, 80, or 90 together, and accompanied with a viscous matter, which makes them stick to the places on which they are laid. These eggs, as may easily be imagined from the size of the mother and the great number which are laid, are so extremely small that one of them would drop through a hole made in a bit of paper with the point of the finest needle. When examined by the microscope, they appear not unlike the nymphs commonly called ant's-eggs; but are streaked length-wise, and seem rough or curdled. The prejudicial effects of this insect in its caterpillar-state, are said to have been prevented by exposing the grain to such a degree of heat as may destroy the ova of the insect, without hurting the vegetative power of the seed.—See *Caterpillar.*

BUTTER-JAGS, a name sometimes applied to the flowers of wild trefoil.

BUTTER-WORT, the name of a plant commonly rejected as food by cattle. It is, however, observed by Mr. Crocker, in the Letters and Papers of the Bath Society, that if the fresh-gathered leaves of this plant are put into a strainer, through which the warm milk, from the cow, is poured, and the milk be set by for a day or two, to become acescent, it acquires a consistence and tenacity; the whey does not separate, nor does the cream. In this state it is an extremely grateful food, and used as such by the inhabitants of Sweden. Half a spoonful of this prepared milk, mixed with fresh warm milk, will convert it to its own nature; and this again will change another quantity of fresh milk, and so on. The juice of the leaves is said to kill lice in sheep and other animals. The common people also use it to cure cracks, or chaps in cows' udders.

BUTTERIS, a tool which farriers make use of, to pare the soles of the feet of horses which are overgrown, or the hoofs to fit the shoes, and to cut off the parts of the sole that overhang the shoes. Too much use is frequently made of this implement in shoeing. See *Shoeing.*

BUTTON *of a Bridle*, is a ring of leather, through which the reins are put, and which run the whole length of the reins. To put a horse under the button, is when he is stopt, having no rider on his back, by the reins being laid on his neck, and the button lowered so far, as that his head is brought in, and fixed to the true posture or carriage.

BUTTY, a provincial term applied to a partner or a fellow-servant.

BUYING *of Horses*, the act of making a purchase of this sort of animal. In this business, from the well-known tricks and management of horse-dealers, much care and circumspection is necessary. Mr. J. Lawrence, in his Treatise on Horses, has given many useful directions on this subject. He observes, that after having been made acquainted with the terms, and that the nag is quiet to approach, giving him some gentle warning with your voice, you should go up to him in his stall, on the near-side, and laying your hand on his fore-hand, "proceed from thence to examine his eyes, mouth, and countenance; still holding his head, and turning your own to the right about, you have a view of the curve of his neck, the height of his fore-hand, and the position of his shoulder and fore-arm. Returning to

his fore-hand, you descend to his legs and feet, minutely examining with your fingers every part from above, below, withinside, and without. You will not forget the virgin integrity of the knees, so much and so justly in request.

"Being satisfied respecting his fore-train, your eye and hand will glance over his back, girting-place, carcase, and loin; thence proceeding to his hinder quarter, and the setting-on of his tail. You will judge how far he agrees in each, and every respect, with the rules of proportion. The hinder legs and feet will, he says, demand a share of attention full as minute as the fore ones, and he must once again repeat his advice, that the inside, or hollow of the hock, be not passed without due notice (as is commonly the case), since it often happens that the injuries of hard labour are most apparent in those parts. A survey of the other side of the horse concludes the stable examination."

It is further advised to "suffer no person belonging to the seller to be with you in the stall during the inspection, that the horse may not be rendered unquiet, either designedly, or at the mere presence of an habitual tormentor."

The reason for which is, that "the examinant will by no means find so good an opportunity abroad, when the horse, according to commendable custom, shall have been fired, and set upon his mettle, and when his own attention must inevitably be divided. The stall is also, he says, a good situation in which to judge of the temper of a horse, his condition, and sound or infirm method of standing."

The "intended purchase is now led out, and so much care has been probably used, during the ceremony of bridling and combing, to rouse his natural and supply him with an addition of artificial fire, that '*warehorse*' is, he says, by no means an unnecessary caution to the by-stander. He is taken to a spot of ground raised for the purpose of shewing his fore-quarters to advantage. Here you have an opportunity of making another general survey, in a good light. It is in this situation you must make a final judgment, respecting that most material object his eyes, taking care to have his head placed favourably for inspection. The next consideration is, the condition of his legs, that he stand straight, and do not knuckle with his knees, that his joints do not tremble (the sure indication of weakness), and that his feet are even, and a just distance apart. Order him next to be walked forward in hand, placing yourself immediately behind him, that you may see how he divides his legs, whether he be straight in his hams, and go sufficiently wide behind, and close before. Keep your position, and let him trot back (still in hand), and you will perceive whether he bend his knees, and goes free from cutting or knocking; whether his feet be sound, and his joints free from stiffness, or injury from hard labour."

He adds, that "after these preliminaries, you may permit the jockey in waiting to mount, who ought to exhibit a fair specimen of every pace, walk, trot, canter, and gallop, having placed yourself, in the interim, about midway of his intended course, forward and back again; in which advantageous situation, you may command a view of the horse, his figure and action, in all directions. In this part of the shew, the particulars to be noted chiefly, are, he says, how the horse carries his head; the degree of freedom he possesses in his shoulders, whether he goes well above his ground, and safe; whether his haunches follow well, and without over-reaching, and whether he submits to the touch of the spur without sucking in his wind, and swelling, which is a sure indication of a rebellious disposition, and that he obeys with reluctance. At the concluding scene, the nag is brought back to that elevated spot just mentioned, when you take another cursory view of him, and he returns to the stable."

The writer "advises no person, however accustomed to horses, to purchase one for his own use, without previously riding him a trial himself; a privilege which no dealer of credit refuses to the extent of two or three miles upon the road, in company with himself or servant. It is, undoubtedly, the way to know all that can be well known of an animal, in so short an acquaintance, first to see him ridden, and then to ride him yourself. You will be enabled to determine, how far his merit is to be attributed to the skill or spurs of the jockey, how far his condition and wind are to be depended upon, and whether he has been merely pampered for sale; whether his carriage be adroit, careful, and safe, over rough ways; whether he be naturally shy and skittish, or has taken aversion to particular objects; and whether he trot down hill in a firm and compact way, naturally throwing his weight upon his haunches, and bearing light on the hand; or whether he lean forward, as if desirous of using his nose as a fifth leg. This last is, he says, a consideration never to be overlooked. A hack, that will not go well down hill, may fairly be pronounced good for nothing, were it only because such good qualification is generally the consequence of being well-shaped, and the backward position of the shoulder, and the inclination forward of the haunches, favouring the attitude most proper for descent. Last of all, there may be something highly disagreeable in the motions or carriage of a horse, which a person can by no other means discover, than by actually riding him; and he has frequently heard men of consummate judgment acknowledge themselves much deceived by trusting entirely to shew."

In respect to "the obloquy which has, in all periods, fallen upon dealers in horses, who have been generally supposed more prone to trick and deception than any other class of traders, it is observed, that it "arises, in part, from the precarious nature of the commodity in which they deal. Their method of preparing and decking out their goods for sale, is wrong, only as far as such manœuvres are intended to conceal unsoundness: but no reasonable objection can possibly be brought against their endeavours to set their horses off to the best advantage. The grand complaint is on the behalf of

humanity, the laws of which are outraged, by the cruel and fraudulent expedients of *figging* and *firing*."

It is added, that "the bargain for a horse is either attended with the *warranty* of 'sound, free from vice or blemish, and quiet to ride or draw;' or he is sold without warrant, to be taken with all faults; in which latter case, the buyer can have no right or pretence to return him, except he prove glandered, which exception he supposes arises from the illegality of selling any horse in that state."

Soundness is defined to imply, "not diseased, lame, blind, or broken-winded: nor having, at the time of sale, any impending cause thereof. By custom, three days trial are allowed the purchaser, within which period the horse ought to be returned for unsoundness: but if the defect lie hid, and the horse can be proved to have been unsound at the time of sale, a much longer detention does not bar the return of the horse; on the other hand, if the seller can prove the soundness, it is presumed the horse has been damaged whilst in the custody of the purchaser, who, in such case, must sustain the loss. In cases of this nature, as well as all others, justice must depend on the last resort, upon the judgment and integrity of the evidence."

It is further stated, that "the impending causes of unsoundness are various; such as rottenness, defects in the eyes and wind, splents, and spavins. The trial of a horse's soundness ought to be committed to a person accustomed to horses. The judgment, as to the goodness of the wind, is now universally guided by the soundness of the cough; but independent of that criterion, the preternatural heaving of the flanks in a broken-winded horse, will always be sufficiently apparent, if he be put upon a swift pace. It is necessary to try the new purchase in all paces, and even to ride him fairly a considerable number of miles, in order to discover any latent defect, or lameness of the sinews, which may have been patched up with bandage and astringents, for the express purpose of sale."

When the purchaser is not perfectly conversant with the nature of horses, it is the best mode to employ some person who is, and who can be fully depended upon.

BYRE, a term made use of in some places to signify a cow-house. It is commonly employed in the northern parts of the island, and in Scotland; and they are differently denominated, according to the uses to which they are applied: thus, there are feeding-byres, turnip-byres, &c. See *Cattle-Shed*.

BYSLINS, a provincial word signifying the first milk of a new-calved cow.

C.

CABALLARIA, an ancient tenure of land, by which it was necessary to furnish a horseman with suitable equipage for the use of the lord in the time of war, and on other occasions.

CABBAGE, the name of a well-known plant, of which there are several kinds cultivated by the farmer, for the purpose of feeding cattle and sheep.

The sorts most commonly employed in this way, are the Scotch, the Drumhead, the American, and the Savoy. Some other varieties may, probably, be also had recourse to with equal advantage, in particular cases and situations.

Mr. Young remarks, that "the great American cabbage, which thirty years ago was to be had, and which came to 50, 60, and even 80 lb. weight, is, he fears, lost at present. And that the great cattle-cabbage, the great Scotch, the Drumhead, the Dutch, and other sorts, are not distinct varieties, and little dependence is to be placed on the manner in which orders to seedsmen are executed. A farmer should, he thinks, at first, get the best stock he can, and then trust only to the seed he raises himself. At present, he is inclined to believe, that the best sort to be procured, is the large red-cabbage. It comes to a good size, and is hardier than most others."

Plants of this kind grow extremely well on any loamy soil, which is in good heart, and made sufficiently fine. For this last purpose, the land should be thrown up in the autumn, that it may enjoy all the advantages of a winter and summer fallow; and as these plants extract their nourishment from a considerable depth, as well as from the surface of the soil, it will also be necessary, that it should be double trenched during the time of fallowing. Immediately after harvest, it is to be turned up, and the workman is to go as deep as he can with his plough: another plough is to follow immediately in the same furrow, with a higher earth-board, which will cast the mould over, and bury the stubble, if it was not done before by some other method: in this manner the field will, as it were, be turned upside-down, double spitted (more than a foot deep, and the stubble be sooner rotted. The harrows must then make the ground as fine as the season will admit. After this, when the weather will permit of it, double trench the land again, and lay it till the spring in sharp ridges. By these means the ground is rendered extremely mellow, but the process is, probably, too expensive for general practice.

It is observed by the above writer, that "the fields designed for cabbages in April or May, and ploughed in October on to the ridge, should in February, if the weather will admit, receive an earth, reversing the ridges, but not stirring flat. This, he thinks, will have good effects in pulverizing the soil, which it may be supposed to want, as it consists only of stubbles turned up in autumn. This is a point that should be attended to; for cabbages are always to be considered as a fallow, in which light their importance must appear sufficiently great. This tillage is the first that marks the land for the crop (all stubbles being ploughed in autumn, for whatever crops designed)."

It is added, that these plants "flourish to very great profit on all good soils, and have the particular property of enabling the farmers of clays and wet loams, to winter more cattle than those of lighter lands can effect, by means of that excellent root, the turnip. The great evil of clay-farms used to be, he observes, the want of green winter food, which confined their stocks to hay alone, and consequently prevented their reaping those extended articles of profit, that arise from numerous heads of cattle: and, besides the immediate benefit from the cattle, they lost also the opportunity of raising large quantities of dung, which never can be effected so well as by keeping cattle. But all these evils are, he asserts, by the cabbage-culture remedied, and the clay farmers put in possession, in many respects, of an equality with the turnip ones. If the difference between a summer-fallow year on clay, and a turnip-fallow on light land, be considered, the importance of this discovery will, he contends, appear sufficiently clear. Thirty shillings an acre expense, of the first, are not an exaggerated calculation; but all is saved on the turnip-land, perhaps with profit; and the barley, that follows the turnips, is, probably, nearly as good as that which succeeds the summer-fallow clay. Supposing, says he, the following clover and wheat equal in both, according to soil, still there remains a superiority in the article manure; for all that is raised by the consumption of the turnip-crop, is so much superiority to the clay soil. But reverse the medal. Suppose cabbages to be introduced on the clay, and the scene is changed. That crop will exceed the turnips, yield more profit, and enable the farmer to make more manure. For these reasons, the recommendation of cabbages appears to be extremely well-

founded; and, consequently, those farmers who possess the proper soils, cannot, he thinks, determine too soon to enter on the cultivation of them. But there is another circumstance attending some sorts of cabbages, which make them highly eligible on all farms, which is their lasting for sheep-feed longer in the spring. Ruta baga, turnip-cabbage, cabbage-turnip, and green boorcole, are in perfection in April, and last even to May, the most pinching period in the year. Turnips will, he says, do no such thing; consequently those farmers who possess turnip-soils, should, on no account, slight the culture of cabbages for this purpose."

There are two seasons for sowing cabbage-seed, in order to raise plants for being set out in the spring and summer. It is remarked, that "the seed for plants intended to be planted out in June, should be sown in February, upon land which has been pared and burnt in August, and carefully manured with rotten dung, so as to become fine, and dug in October, being well raked before sowing: before the farmer determines on this matter, he should, however, consider another mode of cultivation, which is upon the whole preferable, and will preclude his trusting principally to the transplanting method; which is, drilling the seed where the plants are to remain, for which April is the proper season."

It is observed, "that transplanting cabbages demands a very wet time of at least two or three days; and, if hands are not to be procured plentifully, of a longer duration, such a time may not occur when wanted: it must then be waited for, perhaps while the plants are drawing themselves up to long shanks in the seed-bed, and thereby much damaged. This is a great objection to the method, and often causes a light crop on land, which, from soil or preparation, is equal to giving the largest. This inconvenience is, Mr. Young thinks, prevented by drilling the seed where the plants are to remain. It will be the safer way to practise both methods. Three ounces of seed should, he thinks, be sown on each square perch of the prepared nursery, well raked in, and then a peck of soot sown over each rod. A cabbage-nursery cannot, in his opinion, be too rich, nor too much care taken to have fine strong plants, by afterwards thinning carefully. If this crop is meant to be cultivated on a large scale, an acre of land should, he says, be well inclosed for a nursery, kept highly manured, and the seed drilled at nine inches, for the purpose of weeding and hoeing."

But for plants to be set out in the spring or April, the seed should be sown in the last week of August, on land made rich and fine, in the manner directed above, as the plants escape the fly better when sown on land prepared by paring and burning.

On the practice of drilling in the seed in April, where the plants are to remain, which is considered the most certain and profitable culture of these plants, it is observed, by Mr. Young, that they should on this "system follow some hoeing or cleansing crop, such as turnip, a previous crop of cabbages, potatoes, tares, beans or peas, &c. He supposes the land, in the case of its having yielded turnip or cabbage, to have been ploughed the moment the produce was consumed, into such ridges as are intended for the cabbage-seed, either three or four feet wide. If any of the other crops preceded, this ploughing should have been given before the Christmas frosts. Into the furrows of these ridges the dung, thirty cubical yards an acre, in no case less than twenty, should be laid in March, and the ridges reversed directly, covering up the manure and forming new ridges. They should then be left for ten, twelve, or sixteen days, to the influence of the atmosphere. In that state they lie sound and safe from rain. When it is intended to drill, harrowing should precede, or it may be omitted if the soil is very friable and in fine order, as the roller to which the drill is attached will level the crowns sufficiently, and they should not be reduced too much. The Northumberland drill is to be hung to a roller eight feet long for four-feet ridges, or six feet long for three-feet ones. Staples are in the frame of the roller for this purpose, and a chain hooks the drill to them. The roller covers the ridge drilling, and one in advance to be drilled by the next turn. So going on constantly, four pieces of a kitchen-jack chain about two feet long, attached to the drill, to be drawn after it in the centre, will cover the seed better than any other contrivance. The seed is deposited to the desired depth, by pressing on or weighting the drill. If it be half an inch deep, it is sufficient. As soon as the plants appear distinctly above ground, if a surge of soot be drilled upon them to the amount of ten or twelve bushels an acre, it is a great security against the fly. One hopper and one round of Cook's cups, but larger, fixed to such a frame as that of the Northumberland drill, will effect it simply and cheaply. This is all that is necessary to be done in the month of April, and is, he says, the perfection of the cabbage husbandry."

It is remarked, that where cabbage-seed is drilled on ridges in the above manner, in the latter end of summer, "the benefit of the practice has not that superiority which attends the spring drillings, by which a transplantation in June is avoided, as when the seed is sown in August, that operation takes place in a much safer season, or period of the year." It is a good rule, in all cases, to sow seed of this kind at two or three different times.

The land being properly prepared, and the plants provided, they are generally set in rows at the distance of about two feet and a half or three feet, and two feet asunder, where transplanting is followed.

In the Agricultural Report of Staffordshire, it is observed, that some farmers plant them on three-feet ridges, manured under the rows, with soil left between the rows for one plough-hoeing; the hoeing being afterwards finished by hand. Others plant them without ridging, spread the manure promiscuously, and do all the hoeing by hand. Some also

think cabbages are best grown on the same spot or flat of ground every year, which should be allotted and inclosed for that purpose: others grow them in the turnip-field; and they are followed by barley, as it is generally convenient to reserve them for use late in the spring. Sometimes one part of the field is planted with autumnal plants, and the other with spring plants. This, says Mr. Pitt, is the true system, as the former will be large enough for early use, and the latter will stand the winter for use in spring.

And in the View of the State of Agriculture in Mid Lothian, it is stated, that in the vicinity of Edinburgh, in preparing for this crop, the ground is ploughed in November, and again in April following, and well reduced by harrowing, &c. It is then laid out in three-feet drills, thirty carts of dung per acre being laid in the drills, which are then split with the plough covering the dung, and then rolled lengthways, after which the plants are put in, to the quantity of seven thousand two hundred (long hundreds) per Scotch acre, at two feet distance in the rows.

It is also remarked by the author of the Agricultural Survey of the County of Kent, that the tillage necessary for cabbage is to plough the land in the winter six or seven inches deep, and to cross-plough it in the spring in a dry season; and then, after manuring with a good covering of rotten dung, before planting in June, to plough it again, turning over a furrow ten inches wide; and then, by planting every third furrow, the rows of cabbages will stand two feet and a half apart.

And in Suffolk, according to the account of the secretary to the Board of Agriculture, the land is prepared by four ploughings; the last of which buries an ample quantity of dung, and forms the land a second time on three-feet ridges, along the crown of which the plants are set in a rainy season about Midsummer.

It has been observed by the same author, in respect to the preparation of cabbage-fallow, that "if a drought happens in the month of June, and the preparation of the fallow be not very forward, a farmer may be caught with his clods not sufficiently reduced to form the ridges: in this case, there is a tool which has been very effective, in his own practice.

"In preparing his fallows for cabbages this year (1793), he says, he found a use in the Norfolk drill-roller, which he had not discovered before: he had got a ten-acred field, by heavy rolling, and harrowing, and repeated tillage, into pretty good order, and the dung well buried ready for the plants: this field was finished about the ninth of June: at the same time another ten acres were preparing; but here, instead of a large two-ox roller covered with lead, he ordered his bailiff to try the drill-roller, which requires four oxen: the effect was very great indeed: the clods, from a long series of continued dry weather, were large, in spite of five ploughings, and much rolling and harrowing; but once going over with this most effective tool, cut and bruised them to atoms, so that the land then ridged up for dung is in excellent order. He has seen very powerful spiky rollers used, but not with equal effect. He should, however, observe, that no tool in the world can be expected to operate, if a fallow be not prepared properly; that is, ploughed once before winter, and cross-ploughed the moment the north-east winds enable the teams to go on to the land: this year he ribbled one field across, and clean-ploughed one: the latter is by far the most effective, and leaves the fallow rougher and more exposed to drying winds. Rain is of great use in pulverization, for a common pair of harrows, at the right moment, will reduce the roughest land to a fine state; but there is, he says, a vast difference to the temper of the land between reducing it while quite dry, and while wet or even moist: in the former case, friability is entirely preserved; in the latter, the tread of the horses is a pressure, which forms that which will become a fresh clod, and of the worst sort. It may, he thinks, be accepted as a rule in tillage, to work wet and strong soils when quite dry; and of all barbarous management, nothing is so abominable as to let dry seasons pass, in order to plough such lands when rain comes. This Norfolk drill-roller is so effective an instrument for the purpose, that a strong land-farmer should not, he says, be without one; in such a season as this has been, no common tool will reduce land: and for cabbages, the time of rain must be used for setting out the plants, and not lost for pulverizing the land, in order to be planting afterwards in dry weather, or, what is as bad, watering at an expense too great to bear."

It is also advised in his useful Calendar, "in ploughing the manure in, always to throw the land on to the ridge, and set the plants in a single row on the top of each: so that the dung is covered up in the ridges, and the plants in a proper situation for profiting by it to the utmost. As to the distance of the rows, you must, he says, be guided absolutely by the richness of the soil: if you find the plants join from row to row, when at four feet, then you have proof that they should not be planted nearer; but, if they no more than join on three-feet rows, then you would lose in the crop if you gave a greater distance: two feet, from plant to plant, is the proper distance. When the manure is spread and turned in, the proper way of planting will, he says, be to send women or children in with bundles of plants, to drop them on the tops of the ridges, at about two feet distance. They will lay ready for the men, who may then plant almost as fast as they can walk; but, if they have to get, carry, and set the plants, they will not be able to do near the work they might with better contrivance. The rows at four feet may be planted at five shillings an acre. It is a rule among the cabbage-planters in this husbandry, never to water the plants, let the season be as dry as it may, insisting that it is entirely useless. Upon this he shall venture to remark, that in most years, if the land is in fine

tilth, and well dunged, this may be right, as the expense must be considerable; but he should apprehend that, in very dry seasons, when the new-set plants have nothing but a burning sun on them, that watering would save the lives of vast numbers, and might answer the expense, if a *pond* is near, and the work done with a water-cart."

The ground being prepared, in some of the methods as above, for the transplanting practice, the plants, where the cabbages are intended to be made use of in December, January, or February, should be taken from the seed-bed, and set in March or April, from seed sown about the end of July the preceding year; but where the crop is intended for use in March or April, the plants should be set out in the first or second week of July, in good rich garden-soil, from seed sown the February or March before. The late setting of the plants, in the latter case, says Mr. Donaldson, tends to retard their growth in the end of the season, by which means they grow more vigorously, and continue longer good in the following spring.

The author of the New Farmer's Calendar, however, says, that the season for setting out cabbage-plants in fact extends from March to June; but upon middling soils at least, according to his constant observation, no dependence can be placed on the growth of the cabbage beyond the last week in September; and as four months, at least, are requisite to bring the cabbage to maturity and its full weight, a middling crop at best can be expected from late planting; add to this the risk of drought, on account of which the plants may not stir for several weeks. He has tried, he says, experimentally, the various periods of sowing and planting. To sow in February, May, and August, ensures a succession, and completes the cabbage-culture. The earliest sowing is the regular and usual one, and, if the plants be set out in good time, will produce a perfect crop, as heavy, and frequently as forward, as that sown in autumn.

The object of an autumnal sowing is to obtain the plants forwarder, and the cabbages of a larger size; which end is sometimes answered. He has tried two methods at this season, setting out the plants at wheat-seed time, to stand all winter in the field; and leaving them until March, in a warm seed-bed; the latter is preferable, in severe winters, but in the open and mild ones the plants will be forwarder set out in the field. The May or June sowing is with the double view of a very forward crop of large cabbages the succeeding year, or of a crop of coleworts for the following spring: with this latter view, they may be planted thicker than common. They will not all loaf or cabbage, and the plants which run to seed may be drawn for use: or the ripe cabbages having been consumed before Christmas, the coleworts of the May sowing, or those plants which have not loaved, will properly succeed those which have; which, increasing in bulk in the spring, will be in a state of soundness and perfection in April and May, a period when old and full-grown cabbages are either run away to seed, or rotten and useless. By this method, he thinks, the grand objection to the cabbage-culture is done away, which is the certain loss of weight in the crop between November and March, and its frequent total ruin, by the severity of the frost. With him the cabbage has endured the frost better than the kail, or borecole; the latter, beside being stalky, producing much less food.

The other great objection to cabbages, the risk of dry weather at the time of planting, is a powerful reason, he says, for setting them out as early as possible, and giving them the full advantage of the spring showers in the field; on this account, the sooner after the frosts the autumnal plants are fixed in their permanent places the better; and the quicker the spring plants follow them the better also: these last should be all set out by the middle of April at farthest. He advises the farmer not to be sparing of seed in this culture, as no underling plant should be used, and a reserve is necessary to fill up accidental vacancies, which should be done as early as possible. Cabbages have several very dangerous enemies: first, the slug, in their early state, and afterwards when they have loaved; blights, which render them unsound, and stint their growth; and the grub-worm, which destroys their roots, by which the crop is sometimes reduced one-half in quantity, and very considerably in quality. The only remedy of which, he says, is assiduous tillage.

Mr. Boys, in the Agricultural Survey of Kent, thinks that the seed should be sown the last week of March, on a rich warm border of light soil, where the plants may remain till a showery season in June, when they should be transplanted with small iron trowels, in the following method:—The plants being ready drawn from the seed-bed, a woman attends in the field to dip the roots of the plants in fine mould and water, beat together to the consistence of batter; two others then carry them in handfuls, and strew them in small lumps along the furrows ready for the planters; seven men will keep these three women fully employed: they thrust their trowels with their right hand into the land, in a diagonal direction, with the point towards them; and then, by pulling the handle of the trowel a little towards them, the earth is lifted so as to leave a space to put in the plant with the left hand; the trowel is immediately drawn out, and the earth pressed close to the root of the plant with the handle. The land being ploughed straight, and left unharrowed, there is no occasion for lines to direct the planter. By rolling the surface, after the plants are in, the work is finished. In July and August the crop must be kept clear by horse and hand-hoeing.

The plants may, according to others, be set either on the flat surface, or in regular lines, along the crowns of the ridges, and at the distance of three feet from each other. In planting, the sets should be, as has been observed, dropped at due distances, by children, and these followed by the dibblers, who, provided with a stick, to mark the exact distance in this manner, make quick dispatch. A common hand will plant a quarter of an acre in a day, and a good gardener nearly double the quantity.

In the culture of this crop, it was formerly the custom to have four-feet intervals, and a space of two feet between the plants; but it has become the practice lately to abate much of this distance; but the cabbages grown in this way are probably not so large; number, perhaps, compensating the advantage of large size. In this matter, the farmer should however be principally regulated by the nature and state of his land.

If this operation be accurately performed, it will give an opportunity of ploughing or horse-hoeing, not only along the ridges, but also across them,—a mode, which, if adopted, will be attended with several important advantages. It will, in a great measure, save the expense of hand-hoeing, as very little of the soil, except that immediately around the plants, will remain untouched by the plough. They may, for instance, be horse-hoed, two or three times, each way; the first and second times without the mould-board, the rest with it. They should also be hand-hoed two or three times; but the first operation should be that of the horse-hoe, about three weeks or a month after planting.

The crops of cabbages planted out in the spring months, which were hand-hoed and horse-hoed in May, should in June have the second of each of those operations given: a hand-hoeing the middle of the month, which must cut up all weeds, and break the earth well of the narrow slip on which the plants were left. Towards the latter end, the double earth-board plough should go in the intervals, splitting the ridge thrown up in May, and returning it to the rows. These operations will be of great utility to the crop.

The drilled crops put in where they remain in April, also now demand much attention to keep them at a proper distance, the tops of the ridges should be well hand-hoed, and the intervals shimmed, that they may be gradually reduced to a fine state of pulverization. In all horse-hoed crops, these works should be particularly attended to while the plants are young, as when they are much branched out, the implements cannot perform their work with the same effect or correctness.

The crops should likewise be well looked to in July. As they were both hand and horse-hoed in the preceding month, perhaps they may not want any more culture till August; but this depends on the season: if the weeds grow, they should be killed; for the best rule in this matter is, to hoe sufficiently to keep the crop perfectly clean, and to horse-hoe whenever the intervals have been bound by rains or otherwise.

The crops planted in June should be hand-hoed before the middle of the following month, in which work the operator should, Mr. Young says, "be attentive to cut up all the young weeds that grow near the plants, and break all the land on the tops of the ridges; but the men need not hoe the sides of them or the furrows, as the plough in horse-hoeing will cut them much better. Some fresh earth should also be drawn to each plant, earthing it up as it were. The first horse-hoeing should be given soon after; in which operation the plough should take off a furrow from the ridges on each side, and throw up a small ridge in the middle of each interval, which will let the air into the earth on which the plants stand, and pulverize and sweeten it. The cabbages will be left on a narrow slip of earth, ready for the second hand-hoeing, which will be given with great ease. This work must, however, be done with much care and attention, for if the plants are left in too small a space, and the sun be powerful, they will suffer: the stripe of earth the plants are left in should be nine inches wide; and, if the weather is very hot, a furrow turned back again, at least on one side, as soon as may be. Afterwards the horse-hoeing should be given with the shim of three shares; one low, for cutting the bottom of the furrow in the intervals, and two others, four inches higher (being drawn up at pleasure through the block), for cutting the sides of the ridges without removing too much earth from the plants. And this tool should be followed after a time by the double mould-board plough, to sweep out the furrows and round up the ridges.

"And those cabbages drilled where they are to remain, must now be horse and hand-hoed; and in the latter work, whenever it is executed, well pulverized earth free from weeds should successively be drawn to the stalks of the plants, in a perfect manner."

In the beginning of August, "the second horse-hoeing should be given to the Midsummer planted crops of cabbages: the earth thrown into a ridge, in the middle of each interval, by the first, should now be split by the double mould-board plough, and thrown half to one row, and half to the other: this earth, which has been some time exposed to the weather, will be in fine order for the young fibres of the roots to spread in; nor should it be stirred by the succeeding operations: for the cabbage is a plant of such a luxuriant growth, that the roots have power to follow the well pulverized land thus thrown up, and the cabbages will certainly be of a size proportioned to the quantity of food the roots command." And care should likewise be taken to keep the tops of the ridges perfectly clean from weeds by the hand-hoe, as on this being properly performed much depends.

It is remarked by an able writer, that there is one use of this plant which has not met with the attention it deserves, which is, that of planting them on lands where turnips have failed. A late sown crop of these roots seldom comes to a profitable account; but "cabbages planted on the land, without any fresh ploughing, would turn out a beneficial crop for sheep, late in the spring: in all probability (unless on very light sandy, or lime-stone soils), of greater value than the turnips had they succeeded."

He adds, "no farmer can entertain too high sentiments of the necessity of gaining crops of green winter food: the importance of having such food for his cattle, and not depending totally on hay, is one of the clearest axioms, he says, in the whole range of husbandry. His profits will be amazingly les-

sened: his loss in the want of manure felt severely for many years, and on farms not abounding with hay, his expense in buying it, or his loss in selling his cattle, will be equally great. But, besides these accumulated evils, there is another of a different nature, which he should consider well: it is the change of his course of crops. After either turnips or cabbages, he sows spring-corn, and with that spring-corn clover. On some soils, the grass is left but one year, in others two, and in others, mixed with ray-grass, &c. longer. The lay is ploughed up, and wheat at once harrowed in. This is, says he, compendious, cheap, and yet excellent husbandry; for the duration of the grass is a constant fund of profit, at scarcely any expense, and the preparation for corn is carrying on in the most beneficial manner. But, if the turnips fail, and no cabbages be planted, what is the consequence? Why, the farmer sows wheat on the fallow, in hopes of a good crop, to pay him for so much tillage as the land has received. This introduction of that grain at once breaks the whole arrangement of his farm, and he is forced either to begin again, or to pursue that pernicious husbandry of sowing two crops of white corn running. He must either fallow for turnips again, or take a crop of barley, and then turnips: thus is he thrown out of his clover, though as important a crop as any on his farm, and launches into a series of tillage, that cannot but prove very expensive to him, without repaying the benefit that the clover-course would have done. For these reasons, when the turnips fail, and cabbages are not planted, the land should, he thinks, be laid up in winter for barley, and the clover sown with it, which will turn out far more profitable than throwing in wheat."

As cabbage-crops are always considered as a kind of fallow, the more generally and effectually the soil is turned and intermixed, the more completely will the intention proposed by the fallowing be obtained; and, in the next place, as plants are known to become more vigorous on every addition of fresh earth that is applied to their roots, this mode of cultivating cabbages must be considered preferable to all others in this respect, and cannot fail, in ordinary seasons, and with proper attention, to insure a good crop.

Mr. Young, in his Report of the State of Agriculture in Suffolk, estimates the expenses of an acre of cabbages, according to Mr. W. Green's mode of cultivation, as follows:

	£.	s.	d.
Rent - - - - - - -	0	10	0
Tythe - - - - - - -	0	1	6
Poor-rates - - - - - -	0	1	3
Five ploughings - - - - -	1	0	0
Two harrowings - - - - -	0	0	6
Manuring - - - - - -	2	0	0
Seed-bed seed, &c. - - - - -	0	1	6
Planting - - - - - -	0	3	0
Deficiencies - - - - - -	0	0	6
Hand-hoeings - - - - -	0	4	0
Horse-work in hoeing - - - -	0	4	0
Cutting, and carting quarter of a mile	0	15	0
	£5	1	3

This is, however, giving the total expense of the manure to the cabbages; but if the advantage is divided, as it certainly ought, then not more than 15*s.* should be laid to the crop, which will make the total expense 3*l.* 16*s.* 3*d.* The barley or oats that follow cabbages have been thought by some to be inferior to that which succeeds turnips, but in his experience he has not found it so; for he has several times had turnips and cabbages in the same field equally dunged, and the soil and management the same, but has found that the crop gives the best barley which is taken off earliest. And the author of the New Farmer's Calendar gives the following statement respecting the culture of this plant in different methods:

EXPERIMENT ON CABBAGES, ONE ACRE HORSE, THE OTHER HAND-HOED:

Soil, a stiff hazel loam, 20s. per Acre.

HORSE-HOED ACRE.

1790.		DR. £.	s.	d.
Jan. 14,	Ploughing - - -	0	5	0
Feb. 20,	Harrowing twice - - -	0	1	0
Mar. 11,	Dung, twelve loads, at 3*s.* half charged to this crop -	0	18	0
14,	Ploughing second time -	0	4	0
April 20,	Dragging, harrowing, couching	0	3	6
May 14,	Ploughing into four-foot lands	0	4	0
	5,000 plants, at 2*s.* 6*d.* per 1000	0	12	6
	Planting 48 inches by 30 -	0	8	6
June 10,	Ploughing from the rows -	0	2	6
	Hand-hoeing and hilling -	0	3	6
July 1,	Ploughing to the rows -	0	2	6
20,	Earthing up with horse-hoe	0	1	6
Aug. 1,	Hand-weeding and vermin-killing	0	1	6
	Rent, &c. - - -	1	1	0
	Expenses - -	£4	9	0
CONTRA.		CR.		
Dec. 21,	Value of crop, fifty tons -	10	0	0
	Profit - -	£5	11	0

HAND-HOED.

1790.		DR. £.	s.	d.
Jan. 15,	Ploughing - - -	0	5	0
Feb. 21,	Harrowing twice - -	0	1	0
Mar. 11,	Dung - - - - -	0	18	0
14,	Second ploughing - -	0	4	6
April 20,	Dragging, harrowing, couching	0	4	0
May 14,	Third ploughing - -	0	4	0
	Plants 5,500 - - -	0	13	9
	Planting 36 inches by 30 -	0	10	6
June 10,	Hand-hoeing and earthing up	0	12	0
July 20,	Ditto second time - -	0	7	6
Aug. 1,	Hand-weeding, &c. - -	0	2	6
	Rent, &c. - - -	1	1	0
	Expenses - -	£5	3	9
CONTRA.		CR.		
Dec. 21,	Produce, forty-one tons -	8	4	0
	Profit - -	3	0	9
	In favour of horse-hoed acre	2	10	9
		£5	11	0

It is observed by a writer in the Farmer's Magazine, published at Edinburgh, that it is of great importance in husbandry, to provide plenty of food for cattle in winter and spring, when there is very little for them in the fields. The cultivated grasses are now generally introduced, and assist the farmer in this respect greatly. For the same reason, turnips are also very valuable, but subject to fail by the fly, and, in winter and spring, by the frost. On this account, other plants have been, and may be cultivated for winter and spring food; but, among these, he considers cabbages to be of the greatest utility. There are many kinds of cabbages; but, for this purpose, he prefers the large Scots grey to every other, as they thrive in any ground, if well manured.

One great benefit arising from cabbages is, he says, that they give the farmer plenty of green meat for his cows, during the harvest and early winter months; as, by plucking off the outside leaves, no damage is done to the main stock. About the month of December, the crop may be taken up, and brought home to the farmstead, or any other convenient place, where they may be stacked or thatched close up till they are wanted for the cattle; either straw, rushes, or broom, will answer for covering. In this manner, food is always at hand, when access to the field is prevented by storms of frost or snow. Another advantage of raising cabbages is, that the land so employed may be used in the next season in growing potatoes, without any more dung; and, in the third year, be laid down with barley and grass-seeds, much cleaner than if it had been naked summer-fallow

It is stated by a late practical writer, that "cabbage, as well as turnip-crops, are liable to be injured by the attacks of animals of the insect kind at different periods of their growth. While the plants are young and tender in the seed-bed, the beetle or fly often greatly injures or destroys them. The plants likewise occasionally suffer in the seed-bed from the attacks of the caterpillar, produced by the cabbage-butterfly *(papilio brassicæ)*, though less frequently, as this insect makes its appearance in general too late to do much injury to field-crops. The slug sometimes also does much harm to cabbage-plants while young, on their first being planted out, but afterwards they are little exposed to its attacks. The depredations of the fly or beetle, as well as the caterpillar, may in general be, in a great measure, prevented, by the sowing or dispersing of wood-ashes, soot, or other similar matters, in a powdery state, over the young plants, on the first appearance of the insects among them. And the ravages of the slug may be guarded against by the means recommended for turnips." See *Turnips*.

"But besides the attacks of insects on the leaves of the plants, cabbages are, he adds, subject to a disease in the roots, in which they become swelled out and knobby, and the plants weak and of imperfect growth. This vegetable disease has been supposed to be caused by the attacks of grubs below the surface of the ground, and to be chiefly prevalent where the same sort of cabbages are sown and planted on the same spots of ground for several years together."

But it is added, that where "care is taken to plant out the proper hardy sorts of cattle-cabbages, there is little danger of their being injured by the severity of the frosts during the winter months, as seldom more than a few of their large outside leaves have been found to suffer. Many of the hardy varieties of cabbages have indeed been found to stand the winter frosts equally, or even better, where there are frequent thaws, than those of the borecole or kale kinds; but the latter would appear better adapted as a green food, especially for sheep, in the early spring months, as it may be repeatedly eaten down or cut over," and by that means afford a more full supply of green food.

Mr. Young "urges the young farmer to determine to have as many August-sown cabbages as he can want for cattle, sheep, and swine, from the first of October to the last of December. The size they come to is, he says, superior to spring-sown plants, but they will not, in general, last longer than December. The use is however so great, so exceedingly valuable for autumnal fatting of oxen, feeding cows, fatting wethers, feeding hoggit lambs, and supporting the whole herd of swine, that one may, he thinks, without hazard, assert the farmer who does not make a provision of them, to be negligent in a very material point of his business."

There is scarcely any possibility of ascertaining the value of a crop of cabbages by the acre. It is asserted by Mr. Young, that an average crop in Suffolk is estimated at thirty tons the acre, and the value from 4*l.* to 7*l.* The weight, however, must depend as much on the soil and mode of culture, as the value does on the species of live-stock by which the crop is consumed, and the situation of the farm in regard to markets.

There can, however, be little doubt but that this sort of crop is superior to most others in point of quantity. From the statement of Dr. Parry, respecting a crop of winter-cabbages, in the ninth volume of the Letters and Papers of the Bath Society, it indeed appears, that on three acres of land, part of a farm of fifty acres, value of land about 12*s.* per acre, eight rows of cabbages, in number 381, weighed $6915\frac{1}{2}$*lb.* Total number of cabbages on the three acres, 12,170. Total weight of the cabbages (avoiding fractions), 98 ton, 12 cwt. Weight per acre, 32 ton, 17 cwt. and somewhat more.

It must be observed, that these cabbages were weighed with from an inch and a half to two inches and a half of stem. Had they been taken up and weighed with their roots, each cabbage would have weighed, in addition to the above, from 1 to 2*lb.* Supposing each to weigh somewhat more than 1*lb.* there would be an addition to the whole weight of nearly six tons, or two tons per acre. The cabbages were also weighed in the driest weather.

The produce of cabbage-crops must, however, be greatly affected by the quality of the soil, manure, mode of culture, and season.

In a comparison of them with turnips, under several modes of planting on different descriptions of soils, it was found, in taking the best parts of the crops, that a medium acre of the former, on good land, well managed, produced twenty-five tons, while the latter only afforded fifteen tons. And the value of these sorts of crops must greatly depend on the sort of stock by which they are consumed, the manner in which it is performed, and the situation in respect to markets; but, in many situations, it will be ten or twelve pounds, or more.

Cabbage-crops are chiefly used in feeding milch cows, and other kinds of live-stock. It is observed by Mr. Young, in the Agricultural Survey of Suffolk, on the authority of Mr. Green of Bradfield, an extensive cultivator of this vegetable, that he begins to use them a month after Michaelmas for milch cows, and keeps using them so till the end of March; but they ought to be off the land the middle of that month, as they then shoot, and draw the land. Three good acres will do for his dairy of twenty cows, with straw and some hay: but if absolutely no hay, then five acres of cabbages. For weaning calves, they are most excellent. Turnips are apt to give them the garget, by which they very commonly die; but in six years he has lost only one calf in above forty, by feeding them on cabbages, nor can any calves thrive better.

In fattening beasts, he finds that a middling crop will fatten in proportion of three-fourths of an acre for two beasts of fifty stone that have had the summer-grass.

It is remarked, that "in the application or expenditure of cabbage-crops, as they are often liable to a considerable diminution in the quantity or weight of food which they contain, by standing over the winter to the spring months, it may be the best and most economical practice to make use of them late in the autumn, while their leaves are in perfection, in completing the fattening of such neat-cattle or sheep as have been brought considerably forward in the pastures during the summer season. In this way, there is much less loss sustained than is generally the case where they are suffered to stand for spring-feed, by the decay and destruction of the outside leaves and other parts of the plants. In the feeding of milch cows at the same period, they may likewise be of very great utility, as supplying a large proportion of green food, whether the whole plant be made use of, or only the more loose green leaves, which may often be removed without much injury to the cabbages. In this method of application, they have been shewn to be more beneficial than hay, given in any proportion, when only combined with straw; and that the butter is not in any way injured by them while they are given in a sound state. When employed in this way, without any combination of other sorts of food, as hay or straw, an acre has been found to be sufficient for four or five cows, and, with straw and a little hay, for seven or eight. In this mode of consuming cabbage-crops, the cows should always be confined to the farm-yards, and not suffered to eat them after being scattered on the ground; as, in the latter way, the farmer must sustain injury, both in the treading of his lands, and in the loss of a large portion of valuable manure. Besides, he suspects that such sort of food will go much farther when carefully applied in the yard, than when consumed on the land, as much waste must be unavoidable in the latter method."

And it is added, that "in the fattening of neat-cattle, an acre of good cabbages may be nearly sufficient for three beasts of from forty to fifty stone each, which have been grazed in the pastures during the summer. A middle-sized bullock consumes, in general, of this sort of food, in the proportion of about one hundred pounds in twelve hours; but much in this business must constantly depend on the state of the stomach, and the methods of feeding the animals. It would, however, seem probable, that cabbages possess the property of fattening cattle, not only more expeditiously, but in less proportion than turnips; an acre of the former having been found to fatten one in four more than the same extent of the latter crop."

Hogs prefer them exceedingly to turnips; of this Mr. Green has lately had a striking instance; for having a field, part under turnips and part cabbages, his sows, &c. have at various times got into the field, and he does not think they have begun ten turnips in the whole field, but constantly got to the cabbages. But hogs seldom eat this sort of food up in a perfectly clean manner, by which means there is great loss sustained.

It is observed farther, that this practice leaves the farmer without cabbage assistance for a month or six weeks in the spring; part of this time, he thinks, may be supplied by drawing cabbages for about a fortnight, and the remainder by a practice which he has followed many years with success. It is, to keep about twenty acres of his meadow rouen (after-grass) till April, never turning any thing in from the scythe till that time. This is excellent for cows, for ewes, and lambs, especially crones; and he believes it will be found (it has proved so with him) that any piece of rouen that is worth 5*s*. at Michaelmas, will be worth 10*s*. in April, and so in other proportions; but the value will depend a good deal on the weather; in a dry time it goes very far, but in a wet season it is much spoiled. Let it also be remembered, that this grass is saved from a season (autumn) when food is exceeding plentiful, and of little value to those who do not sell.

Cows when fed with cabbages give a great deal of milk, but the butter made from it has been objected to. It is now however known, that the bad taste of butter, when the cows feed upon cabbages, is owing to giving them the decayed leaves; for when these decayed leaves are taken off, and only the sound cabbages given to the cows, the milk and butter are perfectly sweet, and of a rich taste.

Cabbages, with good hay, will likewise make excellent beef and mutton; but it is with them as with turnips, their nutritive qualities depend in a great measure on the richness of the soil on which they are grown. Hard store-pigs thrive on them,

provided tolerably good wash be allowed them at the same time. As a winter green food for sheep, they are also of great value, especially in severe winters, when other sorts of green food are scarce.

The same writer likewise remarks, that "in feeding this crop off with sheep, it has been found, that such as weigh about twenty pounds the quarter, consume in the proportion of from eight to ten pounds in twelve hours, half an acre being nearly sufficient for one hundred sheep when the crop is good;" and that "the cabbages, when run to seed in the spring months, are also consumed with avidity by these animals; but this practice should never be attempted, as much injury must always be sustained by the land. The refuse of cabbage-crops may, however, sometimes be usefully applied in the more early spring months, before they begin to run, to the feeding of lambing ewes, as by such means the quantity of milk is much increased, and the lambs of course better supported."

Horses are likewise said to be fond of them when chopped and mixed with hay.

It is however stated by a late writer, that "though few experiments have been made in the feeding of them with this sort of food, it is probable that, after being chopped, cut, or shaved down by means of a stock or other knife, and blended with some sort of dry cut fodder, it might be employed with great advantage both in the saving of other more valuable kinds of food, and in promoting the condition of the animals; as, from their containing much saccharine matter, there can be little doubt of their possessing a highly nutritious quality. In this use, the more sweet and delicate sorts of cabbage ought probably to be preferred. That the application of this sort of crop in this way has been scarcely attended to is fully shewn, he thinks, by the observation of Mr. Marshall, in his account of the midland districts, who registers it as extraordinary, that neither in that, nor any other district, an instance had been met with of cabbages being made use of in the way of food for horses."

It is remarked by Mr. Young, that the heavy part of Suffolk is the only district in England, that, to his knowledge, has the culture of cabbages established common among farmers; and is, in that respect, curious. They do not have recourse, however, he says, to either turnips or cabbages, as a necessary article in any course of crops, but merely in subservience to the dairy. On the contrary, they are very generally of opinion, that the husbandry with any other view is disadvantageous. The wetness of their land is such, that carting off these crops poaches the soil to an extreme, so that the barley which succeeds them is damaged considerably. This point goes to both; or rather, cabbages being much easier got at, and standing clear above the ground, have, in this respect, a considerable advantage. But the idea among them is very general, that cabbages exhaust the land much more than turnips; he saw two farmers who were not of this opinion; and as it is an interesting point in the cultivation, he made numerous inquiries; and repeated them with such attention, that he believes he brought away the truth very correctly.

The point, that they exhaust more than turnips, seemed upon the whole to be well ascertained; but some circumstances, even in this respect, deserve attention. Several were inclined to attribute this fact to the common practice of cutting off the cabbages, and leaving the shanks and roots in the ground, which throw out sprouts, and draw the land when the effect of the crop ought entirely to have ceased. The remark is, he says, sensible, and some effect must certainly flow from the neglect of not extracting them root and all. It seemed to be a general opinion, that barley after turnips, was better by two coombs an acre than after cabbages; but it was admitted as generally, that the cabbages were superior to the turnips in quantity and value of food, by more than the amount of two coombs of barley. The opinion most common is, that one acre of cabbages is equal to an acre and a half of turnips: several farmers assured him, that it was equal to two of turnips. Mr. Garneys, of Kenton, that an acre of his cabbages has been better than any two of turnips he ever grew; and farther, that though his barley after turnips has had the longest straw, yet he thinks the quantity of corn little superior, and the sample of it not equal. He met with several whose cabbages were done, who thought turnips superior as a preparation for barley, but who wished very earnestly they had planted more cabbages. Mr. Dove, of Euston Hall, thought that barley, after a summer-fallow without dung, would give more, by three coombs an acre, than cabbage or turnip-land would, though dunged for that crop. John Fairweather has had part of a field turnips and part cabbages equally dunged for, and the barley as good after one as the other.

It was universally agreed among all the farmers he conversed with, that cabbages and straw were by far better food for milch cows than any quantity of hay: if this point is well considered, says he, it will be entirely decisive of the question of their merit, and put their exhausting qualities almost out of the inquiry.

On the whole, it may be concluded, that although the general introduction of turnip-husbandry has been the means in a great measure of rendering the field-culture of cabbages less an object of attention in some districts, it is certain, that cabbages are cultivated at small expense; that they are subject to few diseases; that they resist frost more than turnips; and that they are proved to be a palatable and nourishing food for cattle and sheep.

Besides, when a crop of turnips fails, either in whole or in part, which frequently happens, cabbages may, as has been seen above, be planted, on soils of ordinary depth, with the greatest probability of success, and at a very trifling expense,—a circumstance to which every farmer, who cultivates turnips on a large scale, should pay particular attention.

In regard to the custom of packing or piling up this sort of crop in houses for winter use, it has

been observed, that "the practice is said to have been made use of in Germany with such success, as to keep them in a good state of preservation during the whole of the winter season. From the sweet juicy nature of the vegetable, it is, however, supposed that it will be liable, in this method, to be injured, not only by taking on too much heat, but by becoming mouldy. Besides, by keeping in such stacks, they, like the turnip, shrink considerably, and are probably much impaired in their quality." But "in whatever manner cabbages are consumed, it is of importance to the succeeding crops that they be wholly removed from the land in the early part of the spring, before they begin to throw up their flowering stems and run to seed." And it is concluded, that "as cabbages may be cultivated, as seen above, at no great expense, are much less exposed to danger, and capable of resisting the severity of the winter season more effectually than turnips, and at the same time become equally palatable and nutritious to various kinds of animals, there cannot be any doubt but that they may be had recourse to with great advantage in such soils and situations as are not adapted to the turnip-husbandry, and especially wherever a large proportion of green food is wanted for the support of milch-cows in autumn and winter." And "it has been suggested, that in cases where turnip-crops have either wholly or in part failed, and the soils are of an ordinary depth, the lands may be re-cropped with cabbages at a cheap rate, and with the greatest chance of success. This may, therefore, be a point that deserves the notice of the extensive turnip-cultivator on all the stronger kinds of turnip-land."

Turnip-Cabbage, a sort of cabbage not yet much cultivated as an article of husbandry.

It has been remarked, by a late practical writer, that it "is a plant that has been long known to the horticulturist, and which was attempted to be introduced into field-culture many years ago, but without complete success, notwithstanding the results of the experiments that were then made upon it appear to have been much in its favour:" and that, "in this variety of the cabbage, the bulb or apple is of a roundish flat form, appears principally above the surface of the ground, and is as it were an enlargement of the stem of the plant, the leaves that surround it having much resemblance to those of brocoli. It has, he says, been occasionally cultivated under the title of *Cape-cabbage*, and often confounded with the turnip-rooted cabbage by those cultivators who have not sufficiently attended to the circumstances by which they are distinguished: and it seems to be the plant cultivated in many parts of Germany under the title of *Kahlrabi*, which is said to be extremely hardy."

It is observed by the Rev. Mr. Broughton, in the ninth volume of the Letters and Papers to the Bath Society, that "it delights in a dry, elevated, and rather light soil. The seeds may be sown at any time from the end of March to the middle of May; and even later, if not intended to be transplanted. They must be sown very thin, and the plants thinned out to about three inches asunder. The best method is to prepare a part of the land, intended for these crops, as early as possible for the seed-beds, by which means you can conveniently allot good room for those beds, and save the trouble and expense of carrying them from the garden to the field. When the land is prepared, which should be done nearly as for common turnips, and the plants in the seed-beds are from five to seven weeks old, let it be ploughed in small two-bout ridges, let a light roller follow the plough, to flatten the tops of the ridges, and let the plants be immediately put in as nearly as possible in the middle of the ridges, about three feet asunder; observing not to plough more ridges than will be planted in the same day. The stouter the plants are in reason, when transplanted, the better. The land must on no account be ploughed when wet, as the plants put in under such circumstances never thrive. When the plants have taken firm root, and the weeds begin to appear, let a furrow be struck from each side of the ridges, with a plough narrow at the tail, and the ground not moved by the plough be hand-hoed. When the weeds are perfectly withered, before the plants are too large, let the furrow be returned to its place, taking care not to throw the earth over the hearts of the plants."

But the first writer advises "the land to be prepared by ploughing three or four times, in nearly the same manner as for the common turnip; being laid up in the autumn, in order to be rendered fine and mellow by the action of the frosts and other causes during the winter. After being thus well prepared, at the time of planting, it is to be ploughed into small two-bout ridges, and a suitable proportion of manure, according to the state of the soil, turned in. On the ridges, when flatted by a light roller, the plants are to be set out."

It is probable that the seed might be drilled in at once, where the plants are to remain, with the same advantage as in the common cabbage kind: they are also sown broad-cast. But which ever method is adopted, it is advised that "in collecting the seed, care should be taken that no adulteration take place. Where the transplanting method is practised, the seed should be sown sufficiently early to have the plants of a proper size, as of about six or seven weeks' growth, at the time of transplanting. About the middle of March, or beginning of April, may be the properest periods. The seed, in these cases, should be sown very thin, and the weak plants afterwards thinned out, till they are left at not less than three inches distance from each other. Five or six ounces of seed will, in general, be a proportion sufficient for affording plants for setting out an acre of ground. In the drill method, the same proportion of seed may also in common be sufficient, which should be put into the soil about the beginning or middle of April; but if sown later, as in May or June, it frequently succeeds."

In the broad-cast plan, from the plants not coming quickly to the hoe, the latter end of March may

probably be the most suitable period of sowing. In this method, the proportion of seed must be somewhat increased.

In the planting out, "the most eligible time is, as in the common cabbage, when the land has had a good shower of rain; the operations of ploughing and setting out the plants proceeding together: but neither operation should be attempted when the land is much soaked with rain, as much injury is not only done to the land, but the plants seldom thrive well." In this work, "different distances are practised, some preferring the distance of two feet from row to row, and eighteen inches apart in the rows where the soils are good; but in those of inferior quality, not more than twelve: while others advise their being planted two and a half or three feet asunder, on two-bout ridges, the plants being placed as nearly as possible in the middle, immediately upon the dung, as has been recommended for common cabbages."

The work of cultivation afterwards "must be performed in different ways, according to the methods of sowing or planting that have been practised. When the seed is put in by the hand, the crop can only be kept clean by means of the hand-hoe, which should be applied as frequently as is necessary for the purpose." But "in the drill mode, as well as where the crop is planted out with broad intervals and narrow distances in the rows, it may be convenient to make use of both the plough or horse-hoe and the hand-hoe, employing the former in stirring and clearing the intervals, and the latter in keeping the ground between the plants clean. When the crop is planted on ridges, it is recommended, that as soon as the plants have become firmly established in the soil, and weeds begin to appear, to throw a furrow from each side of them by means of a small plough that is narrow behind, stirring the parts not thus moved by the hand-hoe, and after the decay of the weeds thus turned down, but before the plants get too large, to return them to their former situation, care being taken not to cover the hearts of the plants with the earth. These operations may be repeated as frequently as the state of the crop may require." It is remarked, however, "that in the after-culture of this plant, as it forms its bulb above the surface of the ground, the earth or mould should never be laid up so much to the roots of the plants as in the common cabbage, as it may contribute not only to prevent the swelling of the bulbs, but promote their destruction." And it is stated, that "in dry seasons this plant may probably be cultivated with greater advantage than that of the turnip, as not being subject to the destructive attacks of the fly, and being less exposed to danger from other animals that are liable to destroy crops of that sort. When situated close to turnips that have been almost wholly devoured by the fly, it is observed that it has never been perceived that plants of this kind were in the least touched by it." And that, "in good ground, the bulbs or roots frequently attain a considerable size, the largest sometimes weighing eight or ten pounds, and are said to be much more hardy than the common turnip, though not so much so as the turnip-rooted cabbage: but that the quantity of produce on the acre is not probably in general equal to that of the common turnip."

With regard to the application of this sort of crop, it is said to be "chiefly in the feeding of neat-cattle and sheep, during the autumn or spring months, according as it may be sown more early or late; but that the most profitable consumption of it is probably in the latter season, as from the middle of March till it is removed from the ground. In this way it may become an useful assistant to crops of the turnip kind. For this use, it possesses a particular advantage in being formed, as it were, upon a foot-stalk above the surface of the earth; as it can on that account be more conveniently got at and removed during the time of frost, or when snow is upon the ground, than the common turnip. The proportion of nutritious matter contained in crops of this sort is considerable, and of a rich quality. Cows thrive extremely well on it, when it is given them in a judicious manner. When fed off by sheep, the best method is that of hurdling, in the manner practised for common turnips. In this mode of application, they are said to require little or no hay, even where the intention is to fatten the animals, as they make a greater progress with them than on any other sort of food, except that of oats. Both cows and sheep have been found to feed upon the sprouts with avidity, after their having blossomed, and been cut and left to wither. But this practice should seldom or never be attempted, as much injury must constantly be done to the land by the plants being suffered to run to seed. After the bulbs are shrunk and withered, from being cut and packed up in houses, they are said to form a nutritious food for horses." And it is added, that "instead of cutting off the bulbs below the parts where they are formed, in order to preserve them in houses for the above purpose, it is stated in the Annals of Agriculture to be the practice of some cultivators to plough them up wholly, using a common plough, without any coulter, having only a round share with a blunt edge, for the purpose. This is passed along under the rows, and performs the work with much ease, expedition, and in a very effectual manner."

The first of the above writers says, "the best time for feeding off the crop is, from the middle of March to the latest possible time the land can be spared. The sprouts may be cut off when in blossom, and left to wither for the sheep or cows, and the bulbs cut and carried to a barn or shed, where they may be preserved for a long time. When a little withered, they are very good for horses, being highly nutritious, and free from acid juices. If sown early, they might be fed off late in the autumn; but, perhaps, not so profitably as in the spring. It seldom happens, he says, that hay need be given with them, even to fat sheep, which have always been found to thrive more and faster upon them than upon any other food whatever, except corn."

Turnip-rooted Cabbage, a hardy kind of cabbage, cultivated by farmers as a winter food for animals. It differs principally from the former plant

in forming its bulb or protuberance below the surface of the ground, in having it of an oblong shape, and in the leaves having a considerable similarity to those of the common turnip. This plant is probably most suited to the lighter sorts of loamy soils, but thrives well on other kinds.

According to a late writer, "the most suitable soils for the growth of this sort of crop are those of the more friable loamy kinds, or such as have been formed by the gradual deposition of earthy matters from the overflowings of large rivers or the sea. But of whatever kind the soil may be, the parts of it should have been well broken down and reduced by means of tillage, and not be too retentive of moisture, when plants of this sort are cultivated upon it. And that in preparing the land for the crop, it will be necessary to have it brought into a considerable state of pulverization or fineness, by repeated ploughings, and the passing of harrows over it; and also enriched by the application of manure, in the proportion of eight or ten waggon-loads to the statute acre, which should be turned in with the last ploughing in forming the one-bout ridges for the reception of the plants. This is sometimes performed by the common plough, but it may probably be executed with more exactness by one with a double mould-board."

In respect to the seed, it should be carefully selected from the best and most perfect plants, in the manner directed for the common cabbage, and should be employed while it is perfectly fresh, as such seed as has been long kept, seldom vegetates in a regular manner.

Mr. Young says, "if the weather be favourable, March is the proper time for sowing the seed of this plant in a seed-bed, for transplantation in June. It is a remarkable circumstance, he adds, that very great and successful exertions were made in the culture of this plant thirty years ago, but that it went out of general use, without any sufficient reason; for its great merit was then well known."

In cultivating cabbages of this sort, Mr. Tugwell, in the ninth volume of the Bath Letters and Papers, however recommends that "a seminary, or seed-bed, be first sought; and that for every acre to be planted in the field, a provision be made of three perches, rods, or poles, *i. e.* a square bed (and in a fenced garden, if convenient) of ten yards one way, and nine the other; the more rich the better, and at all events clean, and particularly devoid of the seeds of weeds. This, supposed to have been prepared by a winter-fallow, must, about the middle of April, be covered with some short manure; and horse-dung, fresh from the stable, without however the siftings of barn-chaff, and leaving the long part on the mixen, will be very proper, as its effluvia powerfully countermine the devastations of the fly. This must be immediately covered by a shallow furrow, either of the spade or plough, and half a pound of genuine seeds be sown thereon, and covered in with a strong rake, or light harrow; or if this provision has not been made, a piece of turf, pared and burnt, and dressed in like manner, will answer well the immediate purpose; or, in lieu, recourse may be had to the subsoil of a winter sheep-fold, the straw, dung, and a thin turf, having previously been removed. As the plants rise, the fly must sedulously, and may here easily, be attended to; and, if their depredations are discovered, let wood-ashes or soot be slightly, and immediately strewed over the bed, the operator walking on the windward side, and repeated if necessary.

"If before Midsummer, the time for removing the plants to the field, they are observed to advance too fast in their growth, or their stems, from weeds having arisen among them, or any other cause, are drawing out to an improper length, and as thereby they might in a degree lose a proper shape never to be regained, they may, in either or both cases, be prevented by the following method: begin drawing them clean up on one side of the bed, and turning the earth over whereon they stood four or five inches deep with a spade, lay them along the trench forty or fifty in every yard; their roots being then covered with the earth of the next spit, must be gently trodden down, and the digging continued until another trench be formed, about twenty inches from the first, to be supplied in like manner with plants, the next at hand from the seed-bed; and thus regularly proceeding, all must be removed that require it. This checks their growth, and renders them less liable to injury when removed to the field. The operation, however, if the soil and manure be both tolerably free from other seeds, will be very seldom found necessary. The plot intended for their reception at Midsummer, ought to lie in the most fertile part of the turnip-field, but by no means on a clay soil; as, although they may be better able to contend with its tenacity than the common turnip, should wet weather come at the time of their being consumed, it will be found very inconvenient in the feeding of them on the spot, and the land, in all probability, would be thrown out of its season for barley; while to haul them away, if the soil should be at all poachy, would be still more troublesome. The reason for giving them the best part of the field is, under the view of making the less land suffice for the purpose, as the subsequent barley-sowing must necessarily be retarded longer than might otherwise be thought eligible. The plot determined on ought to be well fallowed and pulverised, and eight waggon, or a proportionate number of cart-loads of dung or compost dragged in on an acre. It must then and immediately be thrown into one-bout ridges with the common plough, unless the double mould-board one may be obtained, which would be by far better.

"At Midsummer (if the weather be rainy, so much the better; if not, without long waiting, provided, as before directed, the soil has preparatorily been reduced and made fine), let the plants be drawn from the seed-bed, and tied in bundles of about the size of a peck-measure, each with seven or eight unbroken wheaten-straws, previously a little moistened with water. A tub of water standing by for the purpose, let the root-end of these bundles be dipped therein, and then placed, with their leaves downward, closely in a cart or waggon; and which being filled

with these bundles, root to root and leaf to leaf, may be drawn to the field, thus conducted, with immense numbers of plants. Being there arrived, and women and children employed for the purpose, let each take a bundle on the left arm, and, breaking the straw-band, drop the plants singly along the tops of the ridges, at about the distance of two feet from each other, while dibblers, either men or women, one to a ridge, follow after, and, with the common dibble or setting-pin, plunge them up to the setting on of their leaves, and close them firm in the mould. Here the master, or superintendant, walking behind, must be attentive to the point of the mould being well closed to the roots in every particular row; or some of the dibblers, in view of keeping pace with the others, will ease themselves in this case, and move on without paying due regard to it. It is performed by a stroke or two with the point of the dibble, and on its being properly executed the success of the crop will, in dry weather, very materially depend. They may however be set out upon the plain surface where the land is dry. The usual distances are from two to two and an half, or three feet. It is observed by the above writer that, "if more bundles of plants may have been brought to the field than can be planted the same day, they should (and indeed all others) be kept, as far as necessity will permit, from the action of the sun and wind. The plantation being finished, a vigilant lad may be found necessary for two or three days to keep off the daws and rooks; for these, perceiving the plants in a withered state, will sometimes be led, by instinctive error, to suppose there are grub-worms at their roots, and draw them up again much faster than they were planted."

In regard to the after-culture of the plants, it is stated, that "at the end of about a fortnight (more or less) after planting, the ridges will require hand-hoeing, and the plants thereby to be a little dressed. Soon after this, let the common plough pass twice along each interval; and if the land be clean, and not too compact and close, turn a furrow toward each row, taking care not to bury the plants; if otherwise, the furrows must be turned from the rows, and a ridge be formed thereby in the middle of each interval, bringing the plough for the purpose within about three inches of the plants. This ridge must, within a fortnight or three weeks, in dry weather preferably, be returned again to the rows, and soon after be given another hand-hoeing. This last procedure may with some be thought too expensive; but let it be remembered, that the whole is only equal to a single ploughing, and that the two partial hoeings may be executed for, or nearly, the same price that is usually given for hoeing an acre of turnips; and as the process will not be necessary where the land may not be too condensed and foul for subsequent crops, it will be obvious that a better method cannot be adopted as preparatory for these, while the growing one will be, perhaps, in an equal degree availed of its benefits.

"The time proper for feeding being arrived, which is generally about the middle of April, sooner or later, as indicated by the tops of the plants, after having lain dormant awhile, putting on a bushy appearance, the sheep are to be introduced to them, as to common turnips, with hurdles, &c. and the roots to be preparatorily pulled up with a light mattock-like hook, having a claw on one side of about nine inches length, with a transverse edge at its end of about two inches width, and on the other a kind of hatchet, or, more properly, cleaver; with this the roots may be taken up with ease, its handle, of about three feet and a half in length, acting as a lever for the purpose. When the root is up, it receives a stroke or two with the side of the implement, by which its fangs are in a degree divested of their dirt; and another with the hatchet, or cleaver, on its back, which divides it in two; by such division the sheeps' teeth being introduced to the centre of the bulb, they work their way outward to the shell, and thus, with great facility, devour the whole, or nearly, shell, fangs, and all. Without this method, the feeding would be much more difficult, the bulb being coated with a hard ligneous substance, necessary to its preservation through the winter. Tegs, or one-year old sheep, wethers, and indeed all dry sheep, are preferably to be fed on this root; and when it becomes necessary to introduce couples, or ewes with lambs, thereon, a few small holes, calculated for preventing the sheep, but letting the lambs through, to feed on the foliage of the field at large, must be made in certain of the hurdles. The good effects of this will soon be perceived in the lambs themselves, while nothing could be better adapted for preserving the bulb and preventing it from throwing out too liberally its juices into leaves and branches."

It is remarked in the Agricultural Survey of Kent, that "this is a most valuable plant, and that every farmer who keeps sheep, should have a small piece to eat off in the month of April, after turnips are gone, and before there is a plenty of other herbage. The severest winters do not hurt it; and it produces a great quantity of nutritive and wholesome food: it is however an exhausting crop, and expensive to get out of the ground; but its great value, as a plentiful supply of good food for stock, when, in some seasons, there is nothing else to be had, is more than sufficient to counterbalance every thing that can be said against it.

"In order to obviate some of the objections which have been made to these roots, it will, it is said, be proper to sow them on rich and very light land; and as they are longer after being sown in coming to the hoe than the common turnips, it will be necessary to sow them much earlier."

Were a knowledge of the real properties of this plant generally diffused, it would probably, Mr. Tugwell thinks, "have the happiest effects in preventing in future such general fatality among sheep and lambs, as has lately taken place:—and were it universally understood, that its specific excellences are not, as hitherto supposed, and often asserted, merely resisting frost, and coming to perfection when turnips are all spent; but that it afterwards, although sound, will be of very little use until the season arrives wherein little else can be had, and

that it should hence be kept in reserve for the *greatest exigence* of those who may have been provident enough to secure it.

"The objections that have been usually urged against this plant are," he says, "first, that the toughness of its coat occasions, to sheep fed on it, a premature loss of their teeth:—fortunately, against this assertion," he thinks, "only can be brought, during more than twenty years uninterrupted experience, wherein he annually fed from 3 to 700 sheep, one instance where he believes the loss of a tooth was fairly imputable thereto. It was, however, always a law with him prior to feeding, to pull up the roots, and divide them in the manner described above. Secondly, it has been said, that its fanged roots, carrying much dirt, are found difficult to be consumed, and are frequently left an incumbrance on the soil; this, among many others, is a proof of how little knowledge of the specific and valuable properties of this plant has hitherto been acquired. It is generally known, where the plant has been cultivated, that its roots are fanged, and numerous; while few, it seems, are aware, that these fangs are equally sweet and nutritious with the bulb itself: and that the sheep left to select them, when treated as just described, will all be seen well doing while there is an untouched fang to be found. If, at the end of the season, a quantity of roots are left an incumbrance, it only proves that the sheep fed thereon had, by so much, more given them than they wanted; and that more stock should have been brought on the field.

"After experiencing for a while many disasters, the writer, early in life, set himself earnestly about discovering that great desideratum—a spring-feed for sheep; and, after trying every plant that appeared to stand forward for pre-eminence in the case; viz. *Scotch drum-head cabbage*, large *red cabbage*, *American sugar-loaf cabbage*, *turnip-cabbage*, *borecole*, *black brocoli*, *choux-de-Milan*, &c. &c. found them all appropriately useful; but neither, in any wise, to come in competition with the turnip-rooted cabbage, for the purpose above mentioned; namely, a permanent and stable support for sheep in severe seasons, and critical situations, when and where no other green food can be relied on; and even that expensive article hay will frequently, in dry weather, become disgusting to them. Then," says he, "it is that these may be had recourse to, and depended on, for lifting our sheep-flocks in a respectable way to grass; then it is that these, as a *dernier ressort*, will be found adequate to every useful purpose.

"In taste and consistence they much resemble the kernel of the cocoa-nut, their juices are more oily and less succulent than those of any other root employed for agricultural purposes; and are, probably, in a similar degree, more nutritive than any. They not only in this," continues he, "appear appropriate to the particular season, but, if given to sheep sooner in the winter, will be found comparatively useless, frequently injurious, and sometimes deleterious. While a few warm days will, early in the spring, set the juices of all other vegetables in motion, as preparatory only to future supplies, those of the turnip-rooted cabbage, retaining their original Lapland habits, remain invincibly dormant, motionless, and, as it were, reserved for our intervening use and relief.

"About the middle of April (sooner or later, however, as the spring may be more or less forward) they begin to vegetate, and the foliage on the tops of their bulbs to put on a sort of bushy appearance, and which alone implies their becoming wholesome and nutritive. If at this time sheep are introduced to them, without pulling them up, and splitting them through the middle (which, by the way, ought never to be done), they enter with their teeth on its bulb near the top, and scooping downwards within its ligneous tunic, soon form a calix or cup, containing, according to the size of the bulb, half a pint, more or less; and which the sap, at its critical period suddenly and actively rising, will fill to the top, and frequently flowing over, will run down the sides of the ridge to the length of twelve or twenty inches; or if not, being allowed more than a sufficiency, the sheep devour its flesh, tunic and all, below the surface, and afterwards by their tramplings cover up with dust the remaining part of it, the same disposition prevailing therein, will send up the juices through such dust, flowing in like manner to a considerable distance. At this time, also, the tunic or skin will be found easily separating from the flesh, or internal part of the bulb, as from the same cause, *i. e.* the ascent of the sap, will the bark be separated from the tree it has covered. If, without regarding these intimations, sheep are brought on them sooner in the season, and cold and wet weather should ensue, while they consume a four-fold quantity more than they otherwise would, they will frequently be affected with a sort of white flux; their fæces coming away in a fluid state, and with a white and very singular appearance; while the animals themselves appear wretched, and greatly distressed, and their flesh to be daily falling away. In this case, they are to be immediately removed, and other food given them (where it may be found), and they will recover without farther harm; and when the proper season arrives, as above described, they may again be introduced to these roots, without danger of their being again so affected. There will sometimes, in a dry season, and where on a dusty surface sheep may the day before have dropped their urine, be seen a cast of a deep red colour, as if they were affected with the red water, or made bloody urine; this, however, will not be the case; and as no harm has been known to have accrued from it, no attempts have been made to investigate its cause. It appears wholly to result from a junction of the specific urinal salts, derived from the plant, with those of the earth they unite with, perhaps local, and peculiar to a few soils only.

"As a proof of the permanent, warm, and nutritive qualities of this plant, used in its proper season, as above described, if hay be given to sheep feeding thereon, and while they are allowed their fill

of the roots, it may be observed, they will for the most part reject it; or, however, taking only a little as it were to change their palates, their consumption of this most expensive article will comparatively, with respect to what is requisite at other times, be very trifling, and frequently none at all; while with the plant itself they appear to be so entirely satiated, as frequently after their meals to be seen for some hours lying down, and, in a very singular manner, composing themselves to sleep. So far is this permanent bulb from requiring dry meat as a concomitant, or auxillary, that, if there happen to be a pond in the field, the sheep will frequently be seen drinking thereat; a fact seldom or never observable when, in the spring months, they are feeding on any other green vegetable, or edible root.

"Finally, as a confirmation of the whole of these recommendatory narratives, he has, during twenty years practice, found the produce of an acre of these roots, uniformly, and on an average, adequate to the support of seventy sheep during four weeks of the most hungry, the most trying, and most critical season in the year;—his land, at the present rate, worth about 13*s.* an acre, and each acre producing between 7 and 8000 plants, of about four pounds weight, one with another."

In a communication on this plant to the Society for the Encouragement of Arts, by Mr. Reynolds, it is observed, that "six roots sent for the inspection of the society, indifferently chosen, weighed 38*lbs.* so that upon an average at this time (viz. April 29), there is, he says, no less than thirty-five tons per acre. And let it be observed they are not full grown, the spring being backward, otherwise the product would have been greater. He pitched a fold in the form of an oblong, in two divisions, and placed therein 387 sheep, on April the 2d. The crop has, he says, kept them exceeding well, without any fodder, or even any other provision, (save only the turning them into a rough pasture a few hours in the middle of the day, as by so doing, they return fresh to the roots in the afternoon); and will, he asserts, maintain them in the same manner till the 12th of May, he is confident, which is in all full forty days. He placed those designed for fattening in the front, and the store-sheep in the rear. The plants are drawn up with a three-pronged hoe. The fold is removed daily for those in front to have fresh food: and those in the rear eat the remains of what was left the day before. Thus the whole is spent without the least loss, and the land enriched at the same time. This, he says, by experience, gained last year; for his barley-crop, on land in the same state, turned out very good, both in quantity and quality inferior to none of his other growth (which was upwards of eighty acres); the product full five quarters per acre, sown the 12th of May.

"Eight milch cows have, he adds, been fed with these roots for this month past; and are very fond of them; and he has found great savings in his hay since they began them. Both the milk and butter proved very good, and a considerable increase in both kinds. He also finds, that hogs and pigs like them extremely well. Sows give plenty of milk when fed with these roots. Upon the whole, it is, he thinks, very certain that they are found to be of the greatest utility. Nothing, that he can find out, is more beneficial to the land-holder, for *spring food*, especially in hard weather, and times of distress, such as we have of late very severely felt. This consideration only, ought to encourage all concerned in raising them, were there no other motive whatsoever. But that is not the case; for he finds that besides this great property, of giving plenty in time of need, there is another benefit annexed to it, viz. the improving land for the ensuing crop, when these roots are spent with sheep where they grow. These are circumstances of the greatest merit in agriculture, especially to those who have them in possession.

"These roots are, he says, proof against frost; whereas turnips have been but of little service in general this spring, the frost having destroyed many of them long ago. But these vegetables are now in a fine flourishing state, quite sound and good; well tasted top and bottom: better food cannot be desired for horned cattle and sheep. It seems, indeed, the very thing long sought for (namely), good spring-food. This is certain, his sheep are now thriving beyond all expectation: whilst other flocks, in general, having no such provision, are almost starved to death for want of sustenance. If what is here asserted, and proved by experience, will not induce people to raise these roots, he knows not what will." And in a letter dated the 13th January, he speaks thus of the produce of the turnip-rooted cabbage. "This is certain, large crops have been obtained within the two last years in several counties. Their product have risen from twenty-five to thirty-five tons per acre; and, if his memory serve him right, there are two accounts from Nottingham and York, as high as forty-four tons. Kent and Sussex have obtained near fifty tons; but one gentleman in Surrey has outdone all that he has yet heard of. This plantation, and that no small one, produced upwards of fifty-six tons per acre, in 1770. He has this well attested; and that many of his single roots weighed 14*lbs.* each. This may, he says, seem incredible to some, but it is not so to him in the least. For his shepherd brought him in one single root, on the 4th of May, 1773, that, when cleansed, weighed 17*lbs.* the most extraordinary plant of this kind ever beheld. His curiosity led him to see where it grew, and, on viewing the place he found it stood where a heap of grass-burnt ashes had been ill-spread, and this occasioned its extraordinary size."

This fact is further proved by the large crops of the cabbage kind often produced on lands that have undergone the process of paring and burning.

But, notwithstanding the opinion of the first of the above ingenious and experienced cultivators, we are inclined to consider it as not only a better, but a more œconomical practice, to draw and carry the roots into sheds, or other places made for their reception, than to let them remain in the field till the sap rises, for the purpose of being fed off by sheep or other animals.

CADDOW, a name given to the jack-daw in some of the northern counties.

CADE, a name given to a cag, cask, or barrel. A cade of herrings, is a cask containing five hundred.

CADE *Lamb*, a young lamb brought up in the house, wholly by the hand. Where the ewe dies immediately after lambing, by this means the lamb may be preserved and brought up.

CADMA, a term applied to the smallest of the pigs which a sow has at one farrowing, and which is commonly much less than any of the rest.

CAG, a vessel of the barrel kind, containing four or five gallons.

CAGE, an inclosure formed of wire or wicker, for the purpose of containing different sorts of poultry, or other animals.

CAHYS, a dry-measure of corn, employed in some parts of Spain, which is nearly equal to our bushel.

CAKE, a term applied by farmers to the substance which remains after the oil has been expressed from flax and rape seeds. Cake made from the first of these seeds is much employed in the feeding and fattening of bullocks, and other sorts of cattle. And these articles have likewise sometimes been made use of for the purpose of manure, especially when made from the latter substance. See *Oil-Cake*.

CALAMINE, an ore of zinc, having a white, grey, brown, or red colour, varying in hardness. It is found in Derbyshire, and some other districts; and which is supposed, by some writers, to be capable of being made use of in agriculture with advantage, from its containing oxygen in a large proportion.

CALANDRE, a name given by some French writers to an insect of the sea-crab or beetle tribe, which frequently does great injury in granaries. It has two antennæ or horns formed of a great number of round joints, and covered with a soft and short down; from the anterior part of the head there is thrust out a trunk, which is so formed at the end, that the creature easily makes way with it through the coat or skin that covers the grain, and gets at the meal or farina on which it feeds; the inside of the grain is also the place where the female deposits her eggs, that the young progeny may be born with provision about them. When the female has pierced a grain of corn for this purpose, she deposits in it one egg, or at the utmost two, but she most frequently lays them singly; these eggs hatch into small worms, which are usually found with their bodies rolled up in a spiral form; and after eating till they arrive at their full growth, they are changed into chrysals; and from these in about a fortnight comes out the perfect calandre. The female lays a considerable number of eggs; and the increase of these creatures would be very great, but nature has so ordered it, that while in the egg state, and even while in that of the worm, they are subject to be eaten by mites; these little vermin are always very plentiful in granaries, and they destroy the far greater number of these larger animals.

CALCAREOUS, any thing partaking of the nature and properties of calx or lime.

CALCAREOUS *Earth*, a sort of earth in which calcareous matter abounds. Earths of this kind have the following properties in common. They become friable when burnt in the fire, and afterwards fall into a fine white powder; which is promoted, if, after being burnt, they be thrown into water, by which a strong heat arises, and a partial solution takes place. They cannot be melted by themselves into glass in a close fire. But, when burnt, they augment the causticity of pot-ashes; and they are dissolved in acids with effervescence.

This earth is found pure, in the form of a powder, and called by chemists *lac lunæ*. It is of a white colour, and is met with in some moory situations, at the bottoms of lakes, and in the fissures of free-stone quarries, in some of the midland districts. In some countries, as Sweden, the colour varies to red and yellow. This is supposed to be lime-stone, washed from the rock, and pulverised by the motion of the water. It is however found in quantities too small to admit of any application to agriculture.

And it is met with in a friable and compact state, in the form of chalk. The white chalk is the purest, yet it contains a little siliceous, and about two per cent. of argillaceous earth. There is more fixed air in chalk than in any other calcareous earth, generally about forty per cent.

It is also seen in a hard or indurated state in lime-stone; and united with the sulphuric or vitriolic acid, in the form of gypsum, selenite, or what is generally termed plaster of Paris. It is likewise combined with clay, in the form of marl. See *Lime-stone*, *Gypsum*, and *Marl*.

Lord Dundonald, in his Treatise on the Connection of Agriculture with Chemistry, says, that it "constitutes not only the surface or soil, but likewise the under stratum of many countries, to a very great depth. And that under this general name of calcareous matter is included chalk, marble, lime-stone, coral, shells, &c. The three first-mentioned are frequently mixed with iron, and with different proportions of the simple earths; but are considered as calcareous, when the proportion of that earth predominates. It is capable of absorbing and of retaining moisture, though in a considerably less degree than clay. By the action of fire it becomes lime, and returns again to the state of chalk, or calcareous matter, by exposure to the air or atmosphere."

It is stated by Dr. Fordyce, in his Elements of Agriculture and Vegetation, that when combined with gas or fixed air it is termed mild, but when free from gas or fixed air it is caustic. That calcareous earth, when mixed with clay, gives a greater friability to it than sand does. That it unites with sulphur, forming *hepar sulphuris*, and with animal and vegetable substances, forming a soap. It prevents putrefaction. It attracts acids stronger than volatile alkali or magnesia. If it be exposed to the air, it attracts from it the fixible air, and reverts to the state it was in before it was burnt. Mild calcareous earth

forwards putrefaction. It is insoluble in water, and when it is reduced to a powder, and applied to a soil, it is apt to be washed through it. Caustic volatile alkali will not precipitate calcareous earth, if dissolved in an acid; but fixed vegetable alkali will; this distinguishes it from the other earths. Vitriolic acid will not dissolve it so as to form a clear solution; and if this acid be added to a solution of it in any other, it will make a precipitation.

And it is observed by Dr. Darwin, in his Phytologia, that "one great use of calcareous earths he suspects to consist in its uniting with the carbon of the soil in its pure or caustic state, or with that of vegetable or animal recrements during some part of the process of putrefaction; and thus rendering it soluble in water by forming an *hepar carbonis*, somewhat like an *hepar sulphuris* produced by lime and sulphur, by which process he supposes the carbon is rendered capable of being absorbed by the lacteal vessels of vegetable roots. The black liquor which flows from dunghills is, he thinks, probably a fluid of this kind; but he means to speak hypothetically, as he has not verified it by experiment; and the carbon may be simply supported in the water by mucilage; like the coffee drank at our tea-tables; or may be converted into an *hepar carbonis*, by its union with the fixed alkali of decaying vegetable matter, or by the volatile alkali, which accompanies some stages of putrefaction.

"The second mode of its serving the purposes of vegetation he believes to be by its union with carbonic acid, and rendering it thus soluble in water in its fluid state, instead of its being expanded into a gas; and that thus a great quantity of carbon may be drunk up by the vegetable absorbent vessels. In the practice newly introduced of watering lands by deriving streams over them for many weeks together, he is informed that water from springs is generally more effectual in promoting vegetation than that from rivers; which though it may in part be owing to the azotic gas, or nitrogen, contained in some springs, as those of Buxton, and of Bath, according to the analysis of Dr. Priestley and of Dr. Pearson, yet he supposes it to be principally owing to the calcareous earth, which abounds in all springs, which pass over marly soils, or through calcareous strata; and which does not exist in rivers, as the salts washed into rivers from the soil all seem to decompose each other, except the marine salt, and some magnesian salt, which are carried down into the ocean. The calcareous earth likewise, which is washed into rivers, enters into new combinations, as into gypsum, or perhaps into siliceous sand, and subsides.

"And a third mode, by which it promotes vegetation, he supposes may be ascribed to its containing phosphorus; which, by its union with it, may be converted into an hepar, and thus rendered soluble in water, without its becoming an acid by the addition of oxygen. Phosphorus is probably as necessary an ingredient in vegetable as in animal bodies; which appears by the phosphoric light visible on rotten wood during some stages of putrefaction; in which he supposes the phosphorus is set at liberty from the calcareous earth, or from the fixed alkali, or from the carbon of the decomposing wood, and acquires oxygen from the atmosphere; and both warmth and light are emitted during their union. But phosphorus may perhaps more frequently exist in the form of phosphoric acid in vegetables, and may thus be readily united with their calcareous earth, and may be separated from its acid by the carbon of the vegetable during calcination, and also during putrefaction, which may be considered as a slow combustion. The existence of a solution of phosphoric acid and calcareous earth in the vessels of animals is proved by the annual renovation of the shells of crab-fish, and by the fabrication of the egg-shells in female birds; and is occasionally secreted, where it cements the wounds made on snail-shells; or where it joins the present year's growth of a snail-shell to the part where a membranous cover had been attached, for the protection of the animal during its state of hybernation; and lastly, it is evident from the growth of the bones of quadrupeds, and from the deposition of callas to join them where they have been broken.

"Many arguments," says he, "may be adduced to show, that calcareous earth, either alone, or in some of the sates of combination abovementioned, may contribute to the nourishment both of animals and vegetables. First, because calcareous earth constitutes a considerable part of them, and must, therefore, either be received from without, or formed by them, or both. Secondly, because from the analogy of all organic life, whatever has composed a part of a vegetable or animal, may again, after its chemical solution, become a part of another vegetable or animal; such is the general transmigration of matter!" See *Lime*.

Calcareous *Manures*, are those in which calcareous matter forms the principal ingredient. See *Lime*.

Calcareous *Soils*, such soils as contain large portions of calcareous matter in their composition. Soils of this nature are mostly adapted to the growth of grain, and some of the artificial grasses, as clover, sainfoin, &c. See *Soil*.

Calcareous *Strata*, those distributions of calcareous materials that are formed in beds or layers.

Calcareous *Substances* are all such earthy materials as have much calcareous matter in their compositions.

CALF, the young of the cattle kind of animals. Is is a good practice for the farmer to rear as many calves as he can conveniently keep, in order to keep up his stock; and chiefly such as may fall in the very early spring; for in these seasons the cows' milk may be best spared. By that time too there will be sufficient grass to wean the calves, and by the winter

following, they will have strength sufficient to preserve themselves from being hurt among other cattle, if they have now and then some little help. By midsummer too, the cows will be readier to take the bull, and to bring other calves in proper time. If a cow goes till after May before she calves, the calf will be too weak the winter following; the dam will not be so ready to take the bull again, but often grows barren. Besides, to rear a calf after Michaelmas, and to keep the dam at her meat, as they do in some counties, would be expensive in the winter-time; and a cow abroad will give more milk with a little grass than with fodder, lying in the close-house, or fed with hay or straw, remaining in the stall; for the dry and hard-meat diminishes the milk. Those that have not an extent of pastures had, however, better sell their calves than rear them: they may thus turn the milk to more profit, and the cow will go to the bull again. In winter they should be housed, rather than remain abroad, as young animals are not able to endure severe weather. In the management of calves, whether for the purpose of rearing or feeding, there is considerable difference in different districts, the advantages of the various modes of practice not having yet been fully ascertained by experiments.

Young calves are very subject to a sort of skit or purging, which is highly injurious to them. For this complaint, Mr. Downing advises the following:

Take of prepared chalk, two ounces; pomegranate powder, one ounce; alum, in powder, half an ounce; ginger, in powder, half an ounce; bole armenic, one ounce; opium half a drachm.

Mix these for one dose, to be given in a pint of warm ale, and repeat it as occasion may require.

And when they are inclined to a state of constipation, he recommends the following remedy:

Take of cream of tartar, one ounce; ginger in powder, one ounce; rhubarb, in powder, one ounce; liquorice powder, one ounce.

Mix them for two doses, to be given in a pint of thin gruel or whey, and repeated as occasion may require: one of these doses is sufficient for a large strong calf.

Calf-*Rearing*, the means of bringing up young calves. There can be little doubt but that the best and most natural mode of rearing the young of this, as well as most other kinds of animals, is that of allowing them to suck their dams, at least, for some length of time after they are brought forth. The usual method in Yorkshire is, however, that of giving them milk to drink, there being few instances where they are allowed to suck. For the first two or three weeks they mostly get milk warm from the cow; but for the next two or three weeks, half the new-milk is withdrawn, and skimmed milk substituted in its stead: and at the end of that period, the new-milk is wholly withdrawn; they are then fed on skimmed milk alone, or sometimes mixed with water, till they be able to support themselves by eating grass, or other food of that sort.

But in Cheshire, the practice is to allow the calves to suck for the first three weeks. They are then fed on warm green whey, or scalded whey and butter-milk mixed; with the green whey, water is frequently mixed, and either oat-meal, or wheat and bean flour added. A quart of meal or flour is thought sufficient to mix with forty or fifty quarts of liquid. Oat-meal gruel and butter-milk, with an addition of skimmed milk, are also used for the same purpose. Some one of these prepared kinds of food is given night and morning for a few weeks after the calves are put on that diet, but afterwards only once a-day, till they are three months old or more.

The calves in Gloucestershire are not allowed to suck above two or three days; they are then fed on skimmed milk, which is previously heated over the fire. When they arrive at such an age as to be able to eat a little, they are allowed split beans or oats, and cut hay, and water is mixed with the milk.

And the method practised in Sussex, is still materially different from any of these. It is common there to allow the calves, either to suck for ten or twelve weeks, or to wean them at the end of three or four, and to give them a liberal allowance of skimmed milk for six or eight weeks longer.

The methods pursued by the farmers in Scotland for rearing calves, seem well adapted to the purpose: they are two. The first is, by giving them a pailful, containing about a gallon, of milk, warm from the teat of the cow, morning and evening, for eight or ten weeks. The second, which is certainly the most agreeable to nature, and therefore to be preferred to any other that can be adopted, is to allow the calf to suck its dam, as is sometimes done in the county of Sussex.

Where calves are reared with skim-milk, it should be boiled, and suffered to stand until it cools to the temperature of that first given by the cow, or a trifling degree more warm, and in that state be given to the calf. Milk is frequently given to calves warm only; but that method will not succeed so well as boiling it. If the milk be given over cold, it will cause the calf to skit or purge. When this is the case, put two or three spoonfuls of rennet in the milk, and it will soon stop the looseness. If, on the contrary, the calf is bound, bacon-broth is a very good and safe thing to put into the milk. One gallon of milk per day will keep a calf well till it be thirteen weeks old. A calf may then be supported without milk, by giving it hay, and a little wheat-bran, once a-day, with about a pint of oats. The oats will be found of great service as soon as the calf is capable of eating them. The bran and oats should be given about mid-day: the milk in portions, at eight o'clock in the morning, and four in the afternoon. But whatever hours are chosen to set apart for feeding the calf, it is best to adhere to the particular times, as regularity is of more consequence than many people think. If the calf goes but an hour or two beyond his usual time of feeding, he will find himself uneasy, and pine for food.

It is always to be understood, that calves reared in this manner are to be enticed to eat hay as early as possible; and the best way of doing this is to give

them the sweetest hay in your possession, and but little at a time. Turnips or potatoes are very good food, as soon as they can eat them; and they are best cut small, and mixed with the hay, oats, bran, and such articles.

It may be observed, that it is not absolutely necessary to give milk to calves after they are one month old; and to wean them gradually, two quarts of milk, with the addition of linseed boiled in water to make a gruel, and given together, will answer the purpose, until, by diminishing the milk gradually, the calf will soon do entirely without. Hay-tea will answer the purpose, with the like addition of two quarts of milk; but is not so nutritious as linseed. It is a good method of making this, to put such a proportion of hay as will be necessary into a tub, then to pour on a sufficient quantity of boiling water, covering up the vessel, and letting the water remain long enough to extract the virtues of the hay. When bacon or pork is boiled, it is a good way to preserve the liquor or broth, and mix it with milk for the calves.

In summer, calves may sometimes be reared on whey only; but when reared in winter, they must be fed with hay; and clover-hay is probably the best of any for this use. Calves may also be raised with porridge of different kinds, without any mixture of milk.

It is sometimes a good and convenient plan, the author of the New Farmer's Calendar says, to bring up calves under a step-mother; an old cow, with a tolerable stock of milk, will suckle two calves, or more, either turned off with her, or at home, keeping them in good condition, until they are old enough to shift: they ought to suck the first of their mother's milk, for two or three days, although many are weaned without ever being suffered to suck at all. Calves, whether rearing or fattening, should also always suck before milking, the cow being milked afterwards, as the first and thinnest of the milk is sufficiently rich. Old milk will, perhaps, scour a very young calf; but the effect will go off without any ill consequences. For the last calves he reared, he says, he made use of skimmed milk and second flour, sometimes oatmeal. Began the first week in March. They were of the large, short-horned breed, and consumed daily, at three meals, three quarters of a pound of flour each, boiled up in skimmed milk; it required the milk of more than two ordinary cows to supply two calves. In a few weeks they began to eat fine rouen, to which they were at first tempted by its being made up into twists or bands. Flour omitted 14th May; milk, in part, June 1: totally, June 8th, when they were turned into good grass. They were kept in part of a spare barn at first, afterwards running out and in; but warmth and good bedding appeared of the first consequence to them, being affected by cold and change of weather. One, particularly, scoured a great deal, and always seemed affected by crudities in the stomach: the remedy, occasionally administered, and always successfully for the time, was two small tea-spoons full of rhubarb, in a pint of gruel, or hay-tea. The animal could not, absolutely, have existed, he says, without this aid, during its milk course; and died afterwards, rotten, at grass. One of the small breed, which would not make fat for the butcher, with the best milk and attendance, but heaved, losing flesh daily, and, in fact, laid dying in the pen, he ordered to be put among the weaners, upon the diet of which it recovered, from the instant, and made a small, but strong and hardy cow. This calf was spoiled by the mother of her, a good large beast, being half-starved, when pregnant, upon a common.

The proper degree of warmth for the skimmed milk, on which calves are weaned, he says, is plainly enough indicated by nature. After a while, and when the weaners have been picking about abroad, we are indifferent on the point, and give their mess warm or cold, as it may happen. He has also a good opinion of rice, for the feeding and nourishing, not fattening of animals, and intends to try rice-jelly, mixed with the skimmed milk, in this case.

He observes, that his grace the Duke of Northumberland's receipt is to take one gallon of skimmed milk, and in about a pint of it add half an ounce of common treacle, stirring it until it is well mixed; then to take one ounce of linseed oil-cake, finely pulverised, and with the hand let it fall gradually, in very small quantities, into the milk, stirring it, in the mean time, with a spoon or ladle, until it be thoroughly incorporated; then let the mixture be put into the other part of the milk, and the whole be made nearly as warm as new milk, when it is first taken from the cow; and in that state it is fit for use. The quantity of oil-cake powder may, from time to time, be increased as occasion may require, and as the calf becomes inured to the flavour of it. And Mr. Crook's method is to make a jelly of one quart of linseed, boiled ten minutes in six quarts of water, which jelly is afterwards mixed with a small quantity of the best hay-tea; on this he rears many calves without milk; the author thinks many calves are annually lost by artificial rearing, and more brought up with poor and weak stamina. The mischief arises, according to his observation, from crudities and indigestion, and want of care and comfort, and, not seldom, of the proper natural food. In weak cases, give pollard, wet or dry, or bran and ground oats with fine hay. He has turned them out with their dams, the calves having a prickly head-stall, to prevent their sucking the cows: but it is, he says, a silly and useless practice, plaguing and fretting both animals, to no manner of purpose. There is generally an objection to bringing up white calves, or those with white noses, on the score of their tenderness, but this is probably an absurd notion.

Mr. Donaldson observes, that calves, when dropt during the grass-season, should be put into some small home-close of sweet rich pasture, after that they are eight or ten days old, not only for the sake of exercise, but also that they may the sooner take to the eating of grass. When they happen to be

dropt during winter, or before the return of the grass-season, a little short soft hay or straw, or sliced turnips, should be laid in the trough or stall before them.

In the Rural Economy of Norfolk, it is remarked, that some farmers bring up all the year round, rearing every calf they have dropt. Others rear in winter only, fattening their summer calves for the ped-markets; for, at a distance from them, for the butcher. Norfolk farmers, in general, begin early in winter to rear their calves, some so early as Michaelmas; in common, if their cows come in before Christmas; not only as being fully aware of the advantage of rearing early, but in order that they may rear as many of their own calves as possible; drove calves being always hazardous, and sometimes scarce. No distinction is made as to sex: males and females are equally objects of rearing, and are both occasionally subject to castration, it being a prevailing custom to spay all heifers intended to be fatted at three-years old; but such as are intended to be finished at two-year olds, are, it is believed, pretty generally left "open;" as are, of course, such as are intended for the dairy. There are two reasons for this practice: they are prevented from taking the bull too early, and thereby frustrating the main intention; and by this precaution may lie more quietly—are kept from roving—at the time of fatting. This may be one reason why spayed heifers are thought to fatten more kindly at three-years old, and to be better fleshed, than open heifers. The method of treatment depends, in some measure, on the time of rearing: the winter calves require more milk than the later dropt ones do. Here the general treatment of a calf dropt at Christmas may be said to be this: sucks twice a-day the first fortnight; has the pail twice a-day for the next month or six weeks; and once a-day for a month or six weeks longer,—with hay in a rack, and turnips in a manger; and, sometimes, with oats and bran among the turnips; which last, after a calf has taken freely to them, serves as both meat and drink. In this consists the chief peculiarity of the Norfolk method of rearing calves, which may be said to be with milk and turnips: the last a species of food, which, in every other part of the kingdom, is, it is believed, entirely neglected, or unthought of. As soon as the weather gets warm enough, the calves are turned out in the day, among the fattening bullocks, or on to a patch of turnips, or upon a piece of wheat, or a forward grass-piece, and housed again at night,—until the days growing long, and the nights warm, and the clover and darnel have risen to a full bite, when they are turned out altogether; and continue to have the first bite of every thing, which is good and palatable to them, throughout the summer. This may be called the general treatment of calves dropt at Christmas; but the management of no two farmers is exactly the same.

In the Rural Economy of Yorkshire, Mr. Marshall observes, that oxen are peculiarly subject to a stoppage in the intestines; owing, it is believed, to the "blood-strings" of the testicles being left in the body at the time of gelding. The fact seems to be, says he, that the disorder is generally caused by a link of the intestines being thrown (in playing it is supposed) across a ligature situated near the anus; and the cure is radically effected by breaking this ligature—an operation which is not unfrequently performed. If the ligature be really a string of the testicle, inexterously left in the calf, much caution is requisite in the operation of gelding. An experienced cutter performed it thus: having extricated the testicle, and cut the seminal cord, he forced his finger and thumb upward, as it were, into the body of the calf, (which stood on its legs during the operation) drawing the "blood-string" twelve or fourteen inches long: the point of it appearing not abrupt, as if broken off, but fine as a thread, as if wholly extracted.

Calf-*Suckling*, the art of fattening calves by means of suckling. It has been stated, by a late writer, that the most advantageous stock for fattening calves is that species of cows which give the greatest quantity of milk, richness of quality being not so great an object, or so well adapted to the desired purpose. The Holderness cows are to be preferred in this view; not, however, to suckle calves of the same, but of a smaller breed: perhaps Devon calves surpass all others as sucklers, whether for quickness of proof, or beauty of the veal: they are not, however, to be procured, but in or near their own country.

The method most commonly employed in fattening calves is, to allow them to suck; as by this method the object is probably not only sooner, but more effectually attained than by any other means. The period which is necessary for fattening calves must be different, according to circumstances, but it is generally from seven to nine weeks; however, in the dairy districts, where milk is considered a valuable article, scarcely half that time is allowed. There is another method, which is, to give them the milk to drink; and when that is done, it is given them morning and evening warm from the cow, and the quantity increased according to their age and strength. In whatever way they may be managed, they should be kept in pens in a close-house, and well littered.

The author of the Synopsis of Husbandry observes, that as it is necessary that the calves should lie always quiet, in order that they may indulge in sleep at those times when they are not employed in sucking; it seems proper that the cow-house should be situated in the most retired part of the yard, and that the pens should be kept as dark as possible. But notwithstanding this caution, the calves should by no means be suffered to lie too hot in the summer-time, which would be apt to produce a sickness amongst them. To admit, therefore, an occasional draught of fresh air, let a window be cut in each pen, with shutters adapted to the same, and let these windows be opened whenever the closeness of the atmosphere indicates it to be necessary. In the summer season, they should rarely if ever be closely shut; and when it is required, the stream of air may be

increased by opening the cow-house door at the opposite end of the building. Each calf should have a collar round his neck, to direct him in his suckling, but should never be fastened up in the pen. It is necessary that the pens be kept constantly well littered with the cleanest wheat-straw, a proportion of which should be thrown into them every day; cleanliness being a most essential article in the fattening of every animal, and not more necessary to any than the calf, which, but for this precaution, would in a short time demonstrate the ill effects of lying on his accumulated dung, which of all other animals is the most offensive, and of a quality highly septic. Still as the calves are yeaned, they are to be taken into the pens, and suckled on their own dams, which, at first, will yield a far greater quantity of milk than is necessary for their offspring, so that another calf may be suckled thereon; or the cow may be milked, and the cream be reserved for butter, or applied to any other use, that the owner may think proper. As the calf increases in size, it will require a larger quantity of milk: but whilst they are young, one good cow will yield a noble supply for two calves; and when the whole produce is demanded for one calf, another new milch cow should be provided, and these two cows will abundantly supply the three calves with milk till the oldest is fit for the butcher; after which, if necessary, a fresh suckler may be bought in, and the business be carried on progressively by keeping the house constantly supplied with calves, so that the whole milk may be sucked, as the different branches of the fatted calf and the dairy cannot be so conveniently united.

For many of the southern parts of the kingdom, Smithfield market is the most convenient place to apply for sucklers, so as to be on a certainty of procuring them, this being the general receptacle where the milk-men vend their calves; and these having been bred from the larger Staffordshire or Holdernesse cows, generally turn out to good account for the suckler, such large boned calves, when fattened, arising to a weight much more considerable than the ordinary produce of the country dairymen: and as to the superior quantity of milk required in fattening the larger breed of calves, this is amply recompensed by the greater increase of weight. The only hazard attending this Smithfield bargain is, the accident which may happen to the creature on the road, if the drift has been of any length; for, besides the cow-men above-mentioned, many sucklers are sent to this market from the vale of Aylesbury, and these sometimes meet with accidents either from the lengthened journey or want of milk. From the former, the quiet of the pens generally recovers them, and the ill consequences of inanition may be obviated by stinting the creature to a short allowance for a few meals, till the cause is removed. With these precautions it will, he believes, very rarely be found that any fatal consequences succeed either of these evils. However, it sometimes happens, that, in spite of all our care, the suckler dies in consequence of imprudent management in the vender; but as these accidents are not frequent, they ought not to deter the farmer from replenishing his pen by the London markets, where his vicinity to the metropolis will allow of the practice.

Young calves, he says, when permitted to suck their fill, are often seized with a lax or scouring. To prevent which, the calves for the first fortnight or three weeks may be stinted in their allowance; and at the same time due regard should be taken that they do not pine or decrease in flesh for want of milk. But after this age they should be allowed to suck as long as they choose, and every means ought to be made use of to increase their appetite, and render them more eager after their food. Chalk may be given for this purpose, as well as for giving to the flesh a delicate whiteness. Salt sprinkled in the troughs will likewise act as a stimulus to the appetite; besides which, it is a common practice with some people to cram their calves with balls compounded of flour, pounded chalk, and milk, with the addition of a small quantity of common gin. Of these balls they give two, about the size of a walnut, once a-day, or oftener, to each calf. These balls being very nutritious, in some degree supply the place of milk, and at the same time the spirituous mixture operates on the creatures as a soporific, and thus, by composing them to sleep, increases their disposition to fatten: but where milk can be had in sufficient abundance, it is never worth while to have recourse to these factitious aids. When the demands of the calf, however, are beyond the ability of the cow, these balls come seasonably to thei relief. In order that the calves may be provided with sufficient store of milk, the pastures should still be changed, whenever the cows are found to be deficient in this particular: in the winter-time, such food as is of a succulent nature, as grains, turnips, &c. should be always at hand to supply the want of grass: and these, with a due allowance of the sweetest hay, should be their constant aliment during the time that the cows are confined to the yard.

The prices of suckling calves vary according to the goodness of the young animal, and the time of year wherein the purchase is made. In general, sucklers fetch the largest price in summer, when veal sells the cheapest; and the reason of this arises from the smaller number to be met with at that time than in the spring. A good suckler in London can seldom be bought for less than 20*s.* and is often sold for 25*s.* or 30*s.* The business of suckling was formerly reckoned to turn out to good advantage, when each calf throughout its fattening brought a profit to the farmer of three shillings a week; but now (1799) (so considerably have provisions of every kind been advanced in price within these few years) the profit on the article of suckling is much greater.

When calves are slaughtered at six weeks or two months old, the veal is seldom of a good colour; neither has the flesh of these young calves a taste equal to that where the animal has been suffered to

live a few weeks longer. To attain both these ends of colour and flavour, it is necessary that the calves should be maintained with plenty of milk, and regulated under such management as before directed, till they arrive to the age of eight or ten weeks, according to the season of the year, the more or less kindly state of the calf, the particular demand of the markets, or other eventual circumstances. In the summer season, it may be proper to dispose of them at an earlier period than in the winter; not only on account of their growing away with greater celerity in warm weather, but likewise because of the increased demand for small veal, which is then most saleable. During the last three or four weeks, blood should frequently be drawn from the calf, which will be a likely means towards rendering the veal of a colour delicately white; a circumstance so much attended to by the butcher, that he will commonly depreciate such calves, which, from the appearance of their eyes, are likely to die black, as they term it, though in other respects not to be despised.

Such calves as are suckled on their own dams will, generally speaking, fatten in a shorter time than those which are afterwards bought in to supply their places. The first obvious reason for this difference in their favour is, their not having been removed from the place where they were first dropped, and having always continued to suck the milk of their parent animal, which must in all reason be supposed of a more nutritious quality to them than that of any other cow. Secondly, the cow having so lately calved, the aliment nourishes and fattens in a higher degree than when the creature becomes stale milched. Cow-calves are observed to fatten more kindly than the male or bull-calves; and these last are much more coarse grained, and their flesh less delicate in taste than the former. Calves of the largest size are fattened in Essex, where the business of suckling seems to be better understood, and more properly conducted, than in any other county, and where the farmer keeps the calves to a greater age than in any other part of the kingdom.

Mr. Marshall is clearly of opinion, that to suckle calves in general after they are ten weeks old is bad management; for his account in this respect is uniform—those of nine or ten having paid as much a week as those of twelve or thirteen; and although a calf of six weeks old may suck nearly as much milk as a calf of twelve weeks old, yet the first month or five weeks the quantity is considerably less, and this advantage of their infancy is doubly as valuable to nine as it is to twelve weeks.

There can be no doubt but that the profit of this system of fattening depends materially upon the quickness of return.

In some districts, barley-meal, linseed, boiled into a kind of jelly, and such-like articles, are given to calves in the course of fattening; but the methods above described are greatly superior, although it must be allowed that they may sometimes be considerably more expensive.

CALF-*Weaning*, the practice of weaning calves from the sucking of milk. The most judicious method of keeping up a good breed of cows, either for the pail or the suckling-house, is, the author of the Synopsis of Husbandry observes, to wean every year a stated number of calves; which, having fallen from a kindly dam, will themselves, in all probability, turn out to good account; and having been bred on the land whereon they are in future to be kept, are likely to insure a larger profit than those bought in from distant pastures, and are besides raised at a small expense;—a consideration of very material import to a farmer, and ought to have considerable weight with him in this, and every other part of his business.

Such cow-calves, he says, as are intended to be weaned, should be chosen from those cows which, by experience, are known to produce a large stock of nutritious milk; that have shown themselves of a mild or placid disposition; that are by nature hardy, and of a size adapted to the comparative goodness of the land and situation of the farm. The proper time for weaning calves is in the early part of the spring. Having therefore a cow suited to the purpose, which drops a calf at this season, let it be suckled, according to the usual mode, till it hath completed the third week of its age; when, instead of turning it to the cow, it is to be suckled by thrusting its head into a pail of new milk, and the finger of the person who directs the business is to supply the place of a teat. At first the calf may be rather awkward at sucking the finger, but this will soon become familiar: and after a while a lock of hay may be substituted for the teat; and as the calf advances in age, it will suck the milk out of the pail without any assistance. The milk should at first be given, as observed before, free of adulteration; but, at the end of the first month, a little milk-pottage may be added to each serving. This method should be continued till the calf is twelve or fourteen weeks old, lowering the milk-pottage by degrees, till, at length, it will be brought to simple water only. At the season when the calf is thus weaned from the teat, it ought to be turned abroad, in the day-time, into a small close or orchard near the yard, where there is a good bite of grass, which may be expected at the time of the year when the weaning-calves are of this age; and, as there will generally be more than one calf weaned in a season, they will each be company for the other, and become in a short time reconciled to their situation. It is to be observed, that this pasture should be at some distance from that whereon the dams are turned, and that there be neither ponds nor ditches, nor any annoyance which might endanger the lives of these youthful animals; and, in order to habituate them still more to their pasture, the milk-pottage should be carried clean to them at each of their feeding hours. For the first month or six weeks, the calves ought every night to be brought out of the meadow, and lodged in the pens; but, after this time, they may be left in the pasture as well in the night-season as in the day; and at this time their food may be lowered by degrees, till, as was before observed, it be at

length reduced to simple water only; for, when the calves get to the age of twelve or fourteen weeks, they will no longer require the aid of this sustenance, but will be able to satisfy their appetites by grass. Care, however, must be taken throughout the summer that they be frequently shifted from one pasture to another, in order that they may be kept up in good flesh, and enabled to grow away with the utmost celerity. At Michaelmas, or soon after, the calves should be taken into the yard; and if they were allowed the indulgence of a small close to themselves it would be still better. And here their taste must be gratified with the best and sweetest hay that can be procured, with an outlet on a dry pasture, where in fine open weather they may be suffered to enjoy themselves; and it would redound greatly to their welfare, if, on the approach of winter, a shed was to be erected for them to repose in during the night, and for shelter in tempestuous days. So essential are warmth and good living to young animals of every denomination, that the care which has been taken of them in their early days will be manifest in every stage of their future growth. Nor is there any stock which will pay better for this cautious management in their youth than those of the cow-kind; for if these are stinted in their feed, or carelessly attended whilst in their growing state, they will never arrive to that size which they would otherwise have done, and consequently the loss will be perpetually felt by the farmer, who attempts to raise milch-kine of his own breed without giving them a due attendance in the first year. When the calves have attained their first year, they are called buds, or yearlings; and though at this time they may be able to mix with the herd, yet he thinks it would be most prudent, if not attended with too great an inconvenience, to suffer them to remain in a pasture by themselves. But if this cannot be done, let them be turned out with the dry stock, and not permitted to run with the cows, as this might probably be the occasion of their taking bull, a measure which should, at this time, be cautiously guarded against, as such buds as propagate at this early age will receive a check in their growth on this account: and if, during the succeeding winter, they were to be managed as before directed, he is of opinion, that their future growth would be found to pay ample interest for the fodder that is now given them: only this is to be observed, that as their strength is now considerably augmented, a less valuable fodder may suffice, and good pea-straw may well supply the place of hay. Such farmers who have low rushy meadows, where there is frequently a length of tore in the winter, may in this second year turn the calves into them; and here they will meet with plenty of nourishing food, whilst the weather is fair and open. At two years old the heifer may be suffered to take the bull; but it would, in his opinion, be still better for the cow, and more to the interest of the farmer, if he were to wait a year longer ere this business be completed.

Calf-*Pens*, are places formed for the purpose of receiving calves.

In most places, it is the custom to have the calf-pens annexed to the cow-houses. The only reason, Mr. Beatson observes, in his useful paper in the Communications to the Board, that he can assign why calf-pens should be within the cow-house is, that it saves a little trouble to the dairy-maid, by having a shorter distance to carry the milk. In general, however, it is a plan not to be recommended; as every person who has had any experience among cows must know how naturally, and how forcibly a new-calved cow expresses her attachment to her calf; with what care and anxiety, if permitted, she licks it all over, and uses every exertion to protect it from injury; how the tender calf clings to its affectionate mother, as if sensible that to her alone it can trust for protection: and yet the poor helpless creature, says he, is dragged away, and placed, perhaps, within its mother's view, or at least within her hearing, as if on purpose to augment the pain of her sufferings. Its doleful cries keep alive the pangs of the unhappy cow; she struggles to break the chain that binds her fast, and seems restless and uneasy whenever approached. In such a state of agitation, it is impossible she can either feed well, or give that quantity and quality of milk she would otherwise furnish. Where there are many cows kept, and, perhaps, several of them lately calved, a single calf may keep them all in this restless state: to remedy which, the best way, says he, is to have the calves at such a distance, or at least so thick a wall betwixt them, that the cows cannot hear their cries. The cow will then soon forget her calf, and will both feed and milk the better for it; therefore they should be as near as conveniently may be, without being liable to the above objections.

To lie dry and warm is of the greatest consequence in the rearing of calves, as is evident from what has been already advanced on the subject. Some think it necessary to accustom a calf to be bound with a halter from the hour of its being calved; others again turn them quite loose into the pen, and allow them to range and run about as much as they please. Which of these is the best method is here of little consequence—The principal thing to be observed in the construction of calf-pens is, the laying of the floor, which should be made of laths or spars about two inches broad, laid at the distance of an inch from each other, upon joists, so as to make the floor about one, two, or three feet from the ground, as the situation will admit. This not only keeps them quite dry, by allowing all the moisture to pass immediately away, but has the advantage of admitting fresh air below the bedding, and thereby preventing that unwholesome disagreeable smell, too often found among calves; for it is to be understood, that this place below the floor should frequently be cleaned, as well as the floor itself, whenever it becomes wet or dirty; but it is not right to allow the litter to increase to a great thickness, otherwise the moisture will not so easily pass through. Calf-pens are however too often made without this sparred floor, and the fresh litter always laid on the old, till the calves are removed, which is a slovenly practice, and not by any means to be recommended.

Stalls, or divisions, are but seldom made in calf-

pens: at the same time it would certainly be much better to keep the calves separate from each other; by which means they will be more easily fed, and less liable to accidents. Partitions, about three feet high, of thin deal nailed on small posts, might be so contrived as to be moveable at pleasure, to increase or diminish the stall, if necessary, according to the age and size of the calf. This may be done as represented in *plate* XV. *fig.* 5, which is the ground-plan of a proposed double calf-pen for ten calves. *a* is the door; *b* the passage betwixt the pens; *ccc*, &c. are the pens, showing the situation of the partitions; *dddd* are four joists, in which are several holes, as shown on the plan, for receiving iron pins, at the bottom of the partitions, to keep them in their places; *e* is a window or door, besides which there should be some other windows or air-holes, as high up as possible. If it be thought unnecessary to make the partitions moveable, there might be a small round trough, in a circular frame, fixed in the corner of each pen, as at *f*, for holding the milk, and a door in the next adjoining corner. A small slight rack for holding a little hay, placed at the upper part of the pen, might also be useful. The troughs should be round, that the calves may not hurt themselves upon them, which they might probably do on the angles if they were square. *Fig.* 6, is a section of those pens, in which *rr* shows the position of the racks. The advantages of this kind of calf-pens are, that the calves are all kept separate in a small compass, and cannot hurt each other, as the stronger ones sometimes do the weaker, when confined promiscuously, and their food may be much more easily and equally distributed.

If a great number of calves are feeding, as thirty or forty, or more, it might be so contrived in such pens, by pipes communicating with the troughs, that one person might give the whole calves their milk at the same instant of time: and that any given quantity of milk, and no more, can go into each trough; but as this method would probably be but rarely required by the farmer, it is unnecessary, in a general point of view, to enter into an explanation of it.

In Gloucestershire, Mr. Marshall says, the calf-pens are of an admirable construction; extremely simple, yet singularly well adapted to that intention. Young calves, fattening calves more especially, require to be kept narrowly confined: quietness is, in a degree, essential to their thriving. A loose pen, or a long halter, gives freedom to their natural fears, and a loose to their playfulness. Cleanliness, and a due degree of warmth, are likewise requisite in the right management of calves. A pen which holds seven, or occasionally eight calves, is of the following description:—The house or roomstead, in which it is placed, measures twelve feet by eight: four feet of its width are occupied by the stage, and one foot by a trough placed on its front; leaving three feet as a gangway, into the middle of which the door opens. The floor of the stage is formed of laths, about two inches square, lying lengthway of the stage, and one inch asunder. The front fence is of staves, an inch and a half diameter, 9 inches from middle to middle, and 3 feet high: entered at the bottom into the front bearer of the floor (from which cross-joists pass into the back wall), and steadied at the top by a rail; which, as well as the bottom piece, is entered at each end into the end wall. The holes in the upper rail are wide enough to permit the staves to be lifted up and taken out, to give admission to the calves; one of which is fastened to every second stave, by means of two rings of iron joined by a swivel; one ring playing upon the stave, the other receiving a broad leathern collar, buckled round the neck of the calf. The trough is for barley-meal, chalk, &c. and to rest the pails on. Two calves drink out of one pail, putting their heads through between the staves. The height of the floor of the stage from the floor of the room is about one foot. It is thought to be wrong to hang it higher, lest, by the wind drawing under it, the calves should be too cold in severe weather: this, however, might be easily prevented by litter, or long strawy dung thrust beneath it. It is observable, that these stages are fit only for calves which are fed with the pail, not for calves which suck the cow.

CALF-*Stages*, a term employed in some districts to signify the same as pens, probably from the floor being somewhat raised.

CALKERS, a name given, in some districts, to the prominent or elevated part of the extremities of the shoes of horses, which are forged thin, and turned downwards, for the purpose of preventing their slipping in frosty weather. They are liable to make horses trip; by which strains, and other injuries, may be produced: they should not therefore be made too high, or have a square form. They are single or double; that is, either at one extremity of the shoe or both; the last are supposed less injurious, as they tread more on a level. It is sometimes written *Calkins*.

CALORIC, a term lately employed by chemists for the matter of heat. M. Lavoisier, in the adoption of this term, observes, that "all bodies are either *solid*, *liquid*, or in a *state of aëri-form vapour*, according to the proportion which takes place between the attractive force inherent in their particles, and the repulsive power of the heat acting upon these; or in proportion to the degree of heat to which they are exposed. It is difficult to comprehend their phænomena, without admitting them as the effects of a great and material substance, or very subtile fluid, which, insinuating itself between the particles of bodies, separates them from each other. This substance, whatever it is, being the cause of heat; or, in other words, the sensation, which we call warmth, being caused by the accumulation of this substance; we cannot, in strict language, distinguish it by the term heat, because the same name would very improperly express both cause and effect." He therefore, at first, gave it the names of *igneous* fluid, and *matter* of *heat*. But these being considered as periphrastic expressions, which both lengthen physical language, render it more tedious and less distinct, and frequently not conveying sufficiently just ideas of the subject intended, the cause of heat, or that

exquisitely elastic fluid which it produces, therefore, has been distinguished by the term CALORIC, *considered as the respective cause, whatever that may be, which separates the particles of matter from each other.*" See *Heat.*

CALTHA, the name of a perennial plant, growing naturally in the low meadows in many parts. It is the marsh-marygold. M. Duhamel recommends this plant to the notice of farmers, as very useful to be cultivated as a winter-pasture for cattle.

CAM, a provincial term applied to any long mound of made earth.

CAMMOCK, the name of a troublesome weed infesting arable lands, especially in chalky soils, but more generally known by the title of rest-harrow. See *Rest-Harrow.*

CAMP, a provincial word signifying a hoard of potatoes, turnips, &c.

CAN, a provincial word applied to a small milk-pail, with a handle on one side.

CANAL, an artificial cut or passage, made in the ground for the reception of water from springs, rivers, &c. in order to make a navigable communication between different places.

The particular operations necessary for making artificial navigations depend upon a number of circumstances. The situation of the ground; its vicinity or connection with rivers; the ease or difficulty with which a proper quantity of water can be obtained: these, and many other circumstances, necessarily produce great variety in the structure of artificial navigations, and augment or diminish the labour and expense of executing them. When the ground is naturally level, and unconnected with rivers, the execution is easy, and the navigation is not liable to be disturbed by floods; but when the ground rises and falls, and cannot be reduced to a level, artificial methods of raising and lowering vessels must be employed; which likewise vary according to circumstances.

These sorts of cuts are mostly set out and formed by a sort of imbankment of earth on the sides, and should constantly be under the direction of an able surveyor.

In Mr. Donaldson's View of the present State of Husbandry, it is observed, that the canals already completed or forming have had wonderful effects upon the agriculture, as well as upon the manufactures and general state of many parts of the kingdom; these, and the navigable rivers, render the carriage of bulky articles more easy and less expensive. The conveyance of manure, fuel, &c. into districts, whither, without that medium, they could scarcely have been transmitted, has tended materially to the improvement of these particular districts; and the ease with which the inhabitants can export the produce of the country to otherwise almost inaccessible markets, while it tends to the same end, has also considerable effects on the general markets of the kingdom, and lessens the number of horses that would be requisite for transporting these articles from one place to another.

In passing acts of parliament for making canals, and deepening the beds of rivers so as to render them navigable, he thinks it would materially promote the public interest, were the legislature to examine, with the most scrupulous exactness, the best means to be adopted, in order to prevent the deepening of this river, or the forming of that canal, from affecting the agricultural prosperity of the particular districts. Owing to some cause or other, inland navigations, in many parts of the island, have proved ruinous to the adjoining lands; while, in many others, the injury done to the soil in the districts through which these inland navigations are carried, by obstructing the free passage of the rivers to the sea, and by their frequently overflowing their banks, and destroying the crops in the low grounds, is infinitely greater than any commercial advantages that can possibly be derived from them, except by those who are more immediately interested. To render canals, or inland navigations of any sort, of general utility, says he, much circumspection is necessary in framing the acts of parliament; so that, while the commerce of the country is increased, its agriculture may not be injured. It might, he thinks, be a wise regulation, that in every instance, without exception, all sorts of manure should be carried at one-half or one-third of lockage-dues made payable for articles of any other description. Were this point attended to, and minute investigation made as to the probable consequences that were likely to result from granting leave to form canals, and deepen the beds of rivers, for the purpose of inland navigations, these means of lessening the expense of carriage, would not so often prove injurious to the best interest of the country —its agricultural improvement.

It has been well observed by Mr. Middleton, in his able Survey of Middlesex, that "canals, calculated to navigate much smaller boats than any which have fallen under his observation, even down to ten tons, might be made at a very reduced expense; and after certain leading ones were executed, every man of considerable landed property would find it to be his interest to make a small canal through his estate, at least capable of floating boats of five tons, which would be equally convenient for bringing manure, and to carry away the produce. In all the marsh and fen districts, most of the present sewers would only want, he thinks, a little cleansing to fit them for this purpose."

And he adds, that "the extension of canals may become the most powerful means of promoting general cultivation. Good roads are certainly very essential, and he thinks canals are at least equally so, in an agricultural view. On the best roads, produce and manure can seldom be carried more than ten miles with profit, at the present price of horse-keep: but if canals were as numerous as roads, corn, hay, manure, &c. could be sent to every part of Britain, without using more road than the towing-paths, and to ten times the former distance without increasing the expense. A general canal scheme would, says he, tend to equalize the price of every article in life more than all other things put together. It would afford the cheapest, the safest, and speediest con-

veyance of every article that might be too bulky and heavy for stage and mail-coaches. The benefits would be universal in this island. The inhabitants of London, and its environs, would be infinitely more plentifully and cheaply supplied by canals, than by any system of roads whatsoever. The remoter parts of this, and every other county, would be placed more on terms of equality with those that are near, and every other part of the island might reap advantages, which may be foreseen, but which are much too great for calculation." And he concludes by remarking, that "canals and irrigation might be made the means of cultivating every inch of this island, except rocky ground and mountain tops, and these ought to be planted."

He states, that "of two methods of raising the money for making canals, the one which seems to deserve the preference is, the mode by which turnpike roads are usually provided for, instead of entrusting it to the management of interested companies. The latter method is exceptionable, from its creating a perpetual charge on all goods sent by that conveyance, without regarding the money expended, or the interest it may ultimately produce, which is a very imprudent bargain for the public in this country, where population, trade, manufactures and commerce, are so much upon the increase."

CANARY *Grass*, a kind of grass which can seldom be cultivated with advantage.

CANARY *Seed*, the name of a small seed produced by a gramineous plant cultivated in some of the more southern districts, as Kent, &c. It is observed, in the Agricultural Survey of that county, that there are three kinds of tilths for it: namely, summer-fallow, bean-stubble, and clover-lay; the last the writer considers the best. If the land is not very rich, a coat of rotten dung is frequently spread for it. Whether manured or not, the tillage necessary is, to plough the land the first opportunity that offers after wheat-sowing is done; and, as soon as the land is tolerably dry in the spring, furrows are made about eleven or twelve inches apart, and the seed is sown broad-cast, about four or five gallons per acre, and well harrowed in. When the blade appears, and the rows are distinct, the intervals are immediately hoed with a Dutch hoe, and afterwards, in May or June, the hoeing is repeated with a common hoe; carefully cutting up every weed, and thinning the plants in the furrows, if they are too thick. It is cut in the harvest, which is always later than any corn-crop, with a hook, provincially called a *twibil* and a *hink*; by which it is laid in lumps, or wads, of about half a sheaf of each. The seed clings remarkably to the husk; and, in order to detach it, the crop must be left a long time on the ground, to receive moisture sufficient to destroy the texture of the envelopment, otherwise it would be hardly possible to thresh out the seed. The wads are turned from time to time, to have the full benefit of the rains and sun.

The price of reaping canary, in the Isle of Thanet, was formerly from six to eleven shillings per acre, and the prices of threshing and dressing it five or six shillings a quarter; but at present they are considerably higher. According to the goodness of the land, and the tillage that has been bestowed upon it, the farmers there expect their return to be from twenty-five to fifty bushels per acre; but the common crop is from thirty to thirty-four. It was formerly the practice to sow successive crops on the same land for eight or ten years, but this is now justly exploded; and sowing canary would be a very great improvement to lands which lie convenient for water-carriage to London markets, was it not a crop the farmer ought by no means to depend upon,—not only because the return, or quantity it yields, varies greatly, but also on account of the fluctuation in the price of this seed in the markets.

CANE, a term used to signify a hollow place where water stands. It also implies a wood of alder, or other aquatic trees, in a moist boggy situation.

CANINE, any thing that belongs to the nature of the dog.

CANINE *Madness*, a disease produced in cattle and other kinds of live-stock, as well as in man, by the bite of a mad dog or other animal.

It is observed, in a paper communicated by Dr. A. Fothergill, in the ninth volume of the Bath Society's Transactions, that when the canine poison is first introduced into the human body by a wound, or small scratch as in inoculation, it betrays no sign of acrimony, nor of an actual venomous quality. No violent inflammation, nor swelling of the lymphatic gland above the part affected, ensues, but the wound heals as kindly as any common sore. There it lies dormant an indefinite space of time, most commonly about six weeks, sometimes eight or nine months; and, in some rare instances, even eighteen months: till at length, when the accident is perhaps forgotten, it suddenly becomes active, produces a sense of pain, tingling, or numbness in the part, the first harbingers of impending mischief. To these succeed inquietude, restlessness, and an uneasy sensation about the throat: next follows, accompanied with tremendous spasms, and arrayed in all its terrors, that awful symptom, the hydrophobia, which generally, on or before the end of the fourth day, completes its fatal career.

He adds, that for want of a proper criterion of madness, dangerous mistakes are frequently committed. Thus a favourite dog, in the first stage of the disease, betrays no striking mark of the contagion, and is therefore caressed as usual; nor is he suspected of madness till he has bitten one or more persons in the family, and has afterwards died raving. While, on the other hand, many a harmless dog that happens to be ill of some other complaint, is hastily pronounced mad, and falls a victim to unjust suspicion. The reputed signs, mentioned by Boerhaave and others, such as the dog's sullenness, down-cast look, and refusal of meat and drink, are common to other diseases; but if, in addition to these, he breathe short, foam at the mouth, shun and be mutually shunned by other dogs, desert his master, run staggering in a curved line snapping at bye-standers, he may be presumed to be really mad. But according

to Mr. Meynell, who has made many observations on the distinguishing signs of madness in dogs, the first symptom is, he believes, a failure of appetite in a small degree. He means that the dog does not eat his usual food with his usual eagerness; though, if better food be offered him, he may eat it greedily. A disposition to quarrel with other dogs comes on early in the disease. A total loss of appetite generally succeeds; though he has seen dogs eat, and lap water, the day before their death, which generally happens between seven and ten days after the first symptom has appeared. A mad dog will not, he believes, cry out on being struck, nor show any sign of fear on being threatened; though he will, very late in the disease, appear sensible of kind treatment.

He has never known a mad dog show symptoms of the disease in less time after the bite than ten days; and he has known many instances of dogs having died mad as late as eight months after the bite. A mad dog, in the height of the disorder, has a disposition to bite all other dogs, animals, or men. When not provoked, he usually attacks only such as come in his way; but, having no fear, it is peculiarly dangerous to strike at or provoke him. Mad dogs appear to be capable of communicating the infection early in the disorder, and as soon as they begin to quarrel with or bite other dogs. The eyes of mad dogs do not look red or fierce, but dull; and have a particular appearance, which is easily distinguished by such as have been used to observe it, but not easy to be described.

Mad dogs never bark, but occasionally utter a most dismal and plaintive howl, expressive of extreme distress; and which those who have once heard can never forget. So that dogs may be known to be growing mad, without being seen, when only this dismal howl is heard. Mad dogs do not, he says, foam or froth at the mouth, but their lips and tongue appear dry and foul, or slimy. Though mad dogs generally refuse both food and drink in the latter stage of the disorder, yet they never show any abhorrence or dread of water; will pass through it without difficulty, and lap it eagerly to the last. But it is remarkable, that though they lap water for a long time, and eagerly, and not seem to experience any uneasiness from it, yet they do not appear to swallow a single drop of it; for, however long they may continue lapping it, no diminution of quantity can be perceived.

He is persuaded, that this disorder never originates from hot weather, putrid provisions, or from any other cause but the bite. For, however dogs may have been confined, however fed, or whatever may have been the heat of the season, he never knew the disorder commence without being able to trace it to that cause; and it was never introduced into the kennel but by the bite of a mad dog. The hairs of a mad dog do not stand erect more than those of other dogs. He does not know that there is any thing remarkable in the manner of a mad dog's carrying his head, or his tail. He does not believe that dogs are more afraid of a mad dog, than they are of any other dog that seems disposed to attack them.

There are two kinds of madness, both of which he has known to originate from the bite of the same dog. Among huntsmen, one is known by the name of raging, the other by that of dumb madness. In dumb madness, the nether-jaw drops, and is fixed, the tongue hangs out of the mouth, and slaver drops from it. In raging madness the mouth is shut, except when the dog snaps or howls, and no moisture drops from it.

From the united testimony of various writers, it now appears, says Dr. Fothergill, (though it will, perhaps, hardly be credited) that in the early stage of the disease, a mad dog will eat and drink, and even fawn on the person upon whom he is about to inflict a mortal injury. An alarming consideration! and which demands from the public more than ordinary precaution. That no conclusion can be drawn from the mere taking or refusing food or drink, further appears from some fatal incidents, and which ought to be a caution never to caress or be familiar with stray dogs.

After justly observing, that little dependence can be placed on internal remedies, however much they may have been extolled, he says, the external means of prevention may be performed by ablution, by suction, by extirpation, and by the application of oleaginous substances.

Ablution.—In the bite of a mad dog, the first care ought, undoubtedly, to be to remove as speedily as possible every particle of the poison. For whether it be acid, alkaline, or neutral, water is the universal solvent of all saline bodies. Therefore, after the wound has bled freely, and been well wiped with a dry cloth, it ought to be diligently washed, for the full space of an hour, with a solution of soap in tepid water. This may be done by a soft sponge, a watering-pot, or, perhaps, still better by a syringe. In slight superficial wounds, such a copious ablution alone might possibly be sufficient to prevent future mischief; yet ought not, he thinks, to be entirely depended on, without the following precautions, which may, it is presumed, add considerably to the patient's security. 1st. Previous to the process, let a tight ligature be applied to the limb, a little above the wound, a circumstance that ought always to be premised; otherwise the poison, independently of absorption by the lymphatics, may be conveyed by filtration from cell to cell along the reticular membrane, which invests every fibre of a muscle, and may therefore spread to a certain space beyond the circumference of the wound. 2dly, If the wound be deep, or in an oblique direction, it ought to be first properly dilated, and a cupping-glass applied to encourage a plentiful flow of blood. 3dly, After the wound has been well washed, as abovementioned, let the first dressing consist of dry lint, to absorb the blood and moisture; next morning let the whole surface of the wound be touched in every part with the antimonial or lunar caustic, and kept open, at least, two months.

Suction.—In the Highlands of Scotland, the natives, on receiving a bite from a mad dog, or viper, immediately suck out the blood and poison; and in

the next place, having stuffed the wound with cobwebs (an absorbent animal substance), give themselves no farther concern, and are said to remain free from the infection. In like manner, and with similar success, have certain savage tribes long been in the habit of sucking recent wounds, inflicted by poisoned arrows or by rabid animals; a practice more rational than that which is commonly pursued by more polished nations. While the suction promotes a plentiful flow of blood from the wound, the saliva tends to blunt or subdue the activity of the poison; the operation may, therefore, be performed with safety, and without loss of time, either by the person injured or an attendant, provided his mouth be free from any sore or excoriation: but to avoid even suspicion of contagion, the suction may be tolerably performed with a syringe.

Extirpation.—Of all the external means, the complete extirpation of the injured part is allowed to be the only sure method of prevention.—When the accident, however, happens in the lips, or about the face or neck, it becomes a delicate point, and may occasion no small embarrassment. Indeed, most patients will rather risk the consequence than submit to the operation. In such cases he has occasionally advised the more gentle methods already described, and hitherto with invariable success.—The advocates for absorption contend, that extirpation can avail nothing, if delayed beyond the first day; which is a dangerous mistake. For he once recommended it, and saw it performed with success, about the 7th day; and has lately heard of a remarkable case where it was undertaken on the 28th; and of another after the wound had been cicatrized, and pain begun to be renewed in the part: and yet in none of these cases did any disease ensue. In short, if absorption takes place at all, it probably does not commence till the part affected begins to inflame afresh, and grow painful. He therefore should not now hesitate to recommend the operation at any intermediate period, from the accident till the commencement of the disease. Whether it can avail after the commencement of the dread of water, may, perhaps, deserve a trial. That even at this period the poison still remains local, and neither affects the solids nor fluids, nor any of the secretions, the saliva excepted, seems probable from this consideration, that not only the flesh and milk of cows bitten by rabid animals have been used with impunity, but even the liver of the mad dog himself has often been taken as a remedy, without communicating the disease. Since neither nurses, who inhale the patient's breath, and wipe away the viscid saliva, nor surgeons who open the dead body, receive any injury or infection, the faculty and attendants may safely discharge their duty to the sick without fear or apprehension. Extirpation may be performed by the knife, or by caustic, according as circumstances may point out. The former, being more expeditious, and less painful, claims the preference: besides, in cutting out the diseased part, the mark of the tooth may be more carefully traced, and the line of separation better defined. To whatever depth the bite may penetrate, the incision ought certainly to extend beyond it in every direction; for, should the minutest particle of the poison remain, there can be no security. Here a necessary caution occurs respecting the knife, probe, and other instruments employed in empoisoned wounds, concerning which surgeons cannot be too circumspect. An inoculating lancet, used by mistake in bleeding, has unhappily, in more than one instance, communicated the infection. So in the present case, the knife, imbued with the canine poison, may, through inattention, not only extend the infection to sound parts, and thus defeat the purpose of the operation, but perhaps afterwards—dreadful thought! unfortunately inoculate other persons. That this poison, after lying dormant nine months and upwards, may renew its activity, has been already noticed: therefore, to eradicate entirely any particles that may have eluded the operation, it will be advisable again to wash out the wound carefully with soap and water, and afterwards apply to its whole surface a solution of the caustic fixed alkali (the *kali purum* of the New Dispensatory). After this, should any infection ensue, it can only be attributed to the over-tenderness of the operator, or his inattention to the minuter circumstances above mentioned.

But even the blood issuing from the wound, unless previously absorbed by dry lint, may defeat the action of the caustic. To the efficacy of the *kali purum*, applied to the part, the reports of the Manchester Infirmary bear testimony; this having been the practice these fifty years, from the foundation of the hospital. Of forty persons bitten by mad dogs, being thus treated, all are reported to have remained well. But whether *kali purum* act in common with the antimonial and lunar caustics, or, in addition to its causticity, possess a specific power from its alkaline quality, must be left to future observation. Instead of destroying the part with caustic alkali, the Parisians prefer the application of nitrous acid.

Oleaginous substances.—The ancient remedy against the bite of the viper was long confined to the fat of that reptile, till it was, at length, discovered that olive-oil was equally efficacious—a circumstance since well known to viper-catchers, and confirmed by reiterated experiments. Whether it act by a specific power, or merely by inviscating the poison, or otherwise destroying its activity, matters not; the fact has always appeared to him interesting, and the analogy obvious. Whatever share of success the mercurial ointment may have had in counteracting the canine poison, it has invariably been attributed to the mercury; but he has long suspected it ought rather to have been ascribed to the oily quality of the lard, by which it is compounded, and which constitutes two-thirds of the composition.

That the human body may be thrown into a copious perspiration by friction with warm olive-oil, is a circumstance unnoticed till lately. The effects of this process, as practised at the Smyrna Hospital, in the prevention and even cure of the plague, in the

first stage of infection, are related by count Berchtold, in his late interesting tract on that subject; and since confirmed by the testimony of father Lewis, superintendant of the hospital. If olive-oil, then, be really a preservative against the poison of the incensed viper, and even the pestilential contagion itself, is there not reason, says he, to suspect that oil and oleaginous substances may have had a greater share in counteracting the canine poison than the votaries of mercury ever imagined? It is not pretended, indeed, to be a certain, only a probable, remedy, after the hydrophobia has actually commenced; analogy affording only a presumption, not a proof: nor can its efficacy be fully ascertained, but by repeated trials and attentive observation. As the prevention depends on due management of the wound, this medicine is judiciously ordered to be applied externally for several days. On this, probably, and this alone, ought the main stress to be laid; yet, to calm the patient's mind, and to strengthen his hopes of security, it may not be amiss to give the oil also internally, according to the directions. Previous to this plan of treatment, however, the wound ought to be diligently washed and cauterized.

Whenever cases of this kind occur, whether in man or other animals, attention should be immediately paid to these directions.

Canine *Appetite*. See *Appetite*.

Canine *Teeth*, the teeth between the incissores and grinders, of which there is one on each side in both jaws in most quadrupeds. They have longer roots than those of the first sort. See *Teeth*.

CANKER, in *farriery*, a disease of the ulcer kind, arising from a sharp corrosive humour. It often attacks the feet of horses, and generally proceeds from thrushes, when they become foul and putrid, though many other causes may produce the disorder. The method of cure is generally by hot corrosive applications, such as vitriol, aqua-fortis, and butter of antimony, to keep down the rising flesh, and which may be used daily till the fungus is suppressed, when once in two days will be sufficient, strewing red precipitate-powder over the new-grown flesh, till the sole begins to grow. A great error often committed in the cure of this complaint, is the not having sufficient regard to the hoof; as it should not only be cut off, wherever it presses upon the tender parts, but should be kept soft with linseed oil.

It is stated by Mr. St. Bell, that in cases of confirmed canker, of a long standing, it may be necessary to have recourse to what is commonly denominated *drawing the sole*: this is effected, by dividing the junction between the insensible sole and the horny substance; a pair of pincers and a strong hand, in common practice, usually accomplish the remaining part of the operation. However, when canker is considered as only in its infancy, every diseased portion of the foot should be removed, by means of the drawing-knife, or other instrument. The surface of the insensible sole and frog must then be accurately examined, and every part of the fungous production removed. When a corrosion of the coffin-bone or of the cartilages has taken place, exfoliation is requisite, and may be procured by the application of the actual cautery to the affected spot. The wounds may then be dressed with dossils of tow moistened in spirit of turpentine, tincture of myrrh, or compound tincture of Benzoin. A bar-shoe will be preferable; and the cavity between the foot and the shoe should be so completely filled with tow, or other soft substance, as to produce a firm degree of pressure on the diseased parts. By the assistance of narrow plates of thin iron, applied across each other, having their ends within the shoe, this dressing will be properly retained: where the case will not admit of a shoe, the operator will find no difficulty in substituting some other method.—In about four days, the dressing may be removed, and another applied, composed of honey and burnt alum, which may be repeated every two days. Attention should, he says, be paid that the animal is so situated as to prevent, as much as possible, the admission of external moisture, and should the formation of the new substance prove of a fungous, pulpy disposition, a little powder of vitriolated copper or verdigrease, may be sprinkled on its surface.

Canker *in Dogs*, a diseased state of the skin of the ears, which is cured by a mixture of soft soap, sulphur, and verdigrease, rubbed in every day. Or the ointment of nitrated quicksilver may be used in the same way.

It is also found, that a disease of this kind affects the necks of pigeons. In the cure of which it is said, that the sores should be washed with a strong solution of alum in vinegar, or to apply vitriolated copper to the part occasionally.

Canker, a disease in fruit and other trees, produced by a sort of ulceration in the bark, induced from bruises, or other similar causes. It is observed by the author of Phytologia, that this disease may be termed *gangrena vegetabilis*, and that it is a phagedenic ulcer of the bark, which is very destructive to apple-trees and pear-trees, as it spreads round the trunk or branches, and destroys them. Mr. Knight, he says, has observed it to be most frequent and fatal to those trees the fruit of which has been long in fashion, as they have been perpetually propagated for a century or two by ingrafting, which he believes to be a continuation of the old tree, though nourished by a new stock; and that the canker is thus a disease of old age, like the mortification of the limbs of elderly people, and arises from the irritability of a part of the system.

But it seems more probably, the first writer thinks, to be an hereditary disease; as the buds of trees being a lateral progeny, and more exactly resembling their parents, must be more liable to the diseases gradually acquired or increased by the influence of soil or climate, and have not the probability of improvement which attends the progeny of sexual generation. It is nevertheless frequently produced on trees by external violence, as a stroke with a spade

exposed to those two gasses, as they exist in the atmosphere; and is thus adapted either to promote the generation of nitrous acid, or to form carbonic acid, and thus to assist vegetation. Morasses consist principally of the carbonic recrements of vegetable matters, which are gradually decomposed in great length of time into clay, with argillaceous sand, such as is found over coal-beds, and some calcareous earth, as in marl; and, lastly, with some iron and fossil coal. These by elutriation are separated from each other, and form the strata of coal-countries. In other places they remain intermixed, as they were probably produced from the decomposition of vegetables and terrestrial animals; and form what in books of practical agriculture is called a loamy soil, consisting of carbonic matter, sand, and clay, with a portion of iron. It has always been observed, that this black garden mould, or earth produced from the recrements of vegetables, is capable of absorbing a much greater quantity of putrid effluvia than either air or water, and probably of combining with its ammonia, and producing a kind of hepar carbonis, and thus facilitating vegetation. The practice of burying dead bodies so few feet below the surface is a proof of this; as the putrid exhalations from the carcase are retained, and do not penetrate to the surface. On the same account the air over new-ploughed fields has long been esteemed salutary to invalids, or convalescents, as it probably purifies the supernatant atmosphere. But it was not till lately known that carbon, or charcoal, absorbs with such great avidity all putrid exhalations; if it have been recently burnt, and has not been already saturated with them: insomuch that putrid flesh is said to be much sweetened by being covered a few inches with the powder of charcoal, or even by being buried for a time in black garden-mould; as putrid exhalations consist chiefly of ammonia, hydrogen, and carbonic acid, and are the immediate products of the dissolution of animal or vegetable bodies, they are believed much to contribute to vegetation; as whatever materials have constituted an organic body, may again, after a certain degree of dissolution, form a part of another organic body. The hydrogen and azote produce ammonia, which combining with carbon may form an hepar carbonis, and, by thus rendering carbon soluble in water, may much contribute to the growth of vegetables. It has been said, that some morasses have prevented the animal bodies which have been buried in them from putrefaction; which may in part have been owing to the great attraction of the carbon of the morass to the putrid effluvia, and in part perhaps to the vitriolic acid which some morasses are said to contain in their constitution.

There here occurs, says the doctor, an important question: By what other means is this solid carbon rendered fluid, so as to be capable of entering the fine mouths of vegetable absorbents? The carbon, which exists in the atmosphere, and in limestone, is united with oxygen, and thence becomes soluble or diffusible in water; and may thus be absorbed by the living action of vegetable vessels; or may be again combined by chemical attraction with the lime, which has been deprived of it by calcination. When mild calcereous earth, as limestone, chalk, marble, has been deprived of its water and of its carbonic acid by calcination, it becomes lime. Afterwards, when it is cold, if water be sprinkled on it, a considerable heat is instantly perceived, which is pressed out by the combination of a part of the water with the lime; as all bodies, when they change from a fluid state to a solid one, give out the heat which before kept them fluid. At the same time another part of the water, which was added, is raised into steam by the great heat given out, as above-mentioned; and the expansion of this steam breaks the lime into fine powder, which otherwise retains the form of the lumps of limestone before calcination. But if too great a quantity of cold water be suddenly added, no steam is raised, and the lump of lime retains its form; whence it happens that some kinds of lime fall into finer powder, and are said to make better mortar, if slaked with boiling water than with cold. On this account the lime, which is designed to be spread on land, should previously be laid on a heap, and either suffered to become moist by the water of the atmosphere, or slaked by a proper quantity of water: otherwise, if it be spread on wet ground, or when so spread is exposed to much rain, the heat generated will be dissipated without breaking the lumps of lime into powder; which will then gradually harden again into limestone, disappoint the expectation of the agricultor, and afflict him with the loss of much labour and expense. When the powder of slaked lime, mixed with sand and water, is spread on a wall, that part of the water which is not necessary for its imperfect crystallization evaporates into the air; and the lime then gradually attracts the carbonic acid, which is diffused in the atmosphere: but as he supposes this carbonic acid is dissolved in the water, which is also diffused in the atmosphere, the lime is perpetually moistened by this new acquisition of water from the air; as that, which before adhered to it, and had parted with its carbonic acid, evaporates. On which account new-built walls are months, and even years, in drying, as they continue to attract water along with the carbonic acid from the air, which stands upon them in drops, till the lime regains its original quantity of carbonic acid, and again hardens into stone, or forms a spar by its more perfect or less disturbed manner of crystallization.

He therefore supposes that the earth acquires carbon, both in a manner similar to the above, by its attracting either the carbonic acid, or the water in which it is diffused, from the atmosphere, and also by the specific gravity of carbonic acid gas, being ten times greater than that of common air; whence there must be constantly a great sediment of it on the surface of the earth, which in its state of solution in oxygen and water, may be readily drunk up by the roots of vegetables. Another means by which vegetables acquire carbon in great quantity may be from limestone dissolved in water; which, though a slow process, occurs in innumerable springs of water which pass through the calcareous or marly strata of the earth; as those of Matlock and Bristol in passing

through limestone, and those about Derby in passing through marl; and is brought to the roots of vegetables by the showers, which fall on soils where marl, chalk, limestone, marble, alabaster, fluor, exist, which includes almost the whole of this island. By this solution of mild calcareous earth in water, not only the carbon in the form of carbonic acid not yet made into gas, but the lime also with which it is united, becomes absorbed into the vegetable system, and thus contributes to the nutriment of plants, both as so much calcareous earth, and as so much carbon. And another mode may be by the union of this simple substance, with which all garden-mould abounds, with pure calcareous earth into a kind of hepar, analogous to the hepar of sulphur made with lime, which abounds in some mineral waters. And this he supposes to be the great use of lime in agriculture. For the purpose of ascertaining the probability of this mode of solution of carbon, he made the following experiment: About two ounces of lime, in powder, were mixed with about as much charcoal, in powder, put into a crucible, and covered with an inch or two of siliceous sand The crucible was kept red-hot for an hour or longer, and then suffered to cool. On the next day, water was poured on the lime and charcoal, which then stood a day or two in an open cup, and acquired a calcareous scum on its surface And though it had not much taste, except of the causticity of the lime, yet on dropping one drop of marine acid into a tea-spoonful of the clear solution, a strong smell like that of hepar sulphuris was perceived, or like that of Harrogate water; which evinced, that the carbon was thus rendered soluble in water. Hence he suggests, that the sulphureous smell of Harrogate and Keddleston waters, and other similar springs, may be owing to the union of the alkali of decomposing marine salt, with the carbon of the earth they run through, and that this kind of water might thus possibly be used as a profitable manure in agriculture. And a still further mode by which vegetable roots acquire carbon, is suspected to be by their disuniting carbonic acid from limestone in its fluid, not its gaseous, state; which the limestone again attracts from the atmosphere and consolidates, or from other matters included in the soil. First, because lime is believed by some agricultors, who much employ it, to do more service in the second year than in the first; that is, in its mild state, when it abounds with carbonic acid, than in its caustic state, when it is deprived of it. Secondly, that the use of burning lime seems, hence, to be simply to reduce it to an impalpable powder, almost approaching to fluidity, which must facilitate the application of the innumerable extremities of vegetable fibres to this incalculable increase of its surface; which may thence acquire, by their absorbent power, the carbonic acid from these minute particles of lime, as fast as they can recover it by chemical attraction from the air, or water, or from other inanimate substances in their vicinity. Thirdly, the hyper-oxygenation of the perspirable matter of plants, which thence gives up oxygen gas in the sunshine, would, he says, induce us to believe that a great part of the carbon, which furnishes so principal a part of vegetable nutriment, was received by their roots in the form of carbonic acid; and that it becomes in part decomposed in their circulation, giving up its oxygen; which thus abounds in the secreted fluids of vegetables from this source, as well as from decomposed water, as is generally known.

And lastly, there is another way by which carbon is received into the vegetable system, which is by its existence in sugar and in mucilage; both which are taken up undecompounded, as appears by their presence in the vernal sap-juice, which is obtained from the maple and the birch; which, like the chyle of animals, is absorbed in its undecompounded state by the roots of plants.

This matter may, therefore, be considered as one of the principal constituent parts of vegetables; and would seem to enter into and accumulate in the constitution of plants in proportion to their successive growth. Some plants, however, take more into their composition than others, as, from the results of chemical analysis, a quantity almost equal to all their other component parts has been found in particular instances, as in Agaricus *piperatus*; Clavaria *aurea*; *agaricus*, Lycoperdon *tessellatum*, while in others only a very small portion.

CARBONACEOUS *Matter*, that kind of earthy matter that partakes considerably of the nature of carbon, or in which it abounds. It is found that materials of this sort are highly useful in promoting the growth of plants.

CARBONATE, a term applied, by modern chemists, to saline substances, formed by the union of carbonic acid with different bases.

CARBONATE *of Lime*, is a term applied to lime in a state of combination with carbonic acid. This sort of union is frequently met with in nature, and extends to all the stony substances which are distinguished under the title *calcareous*; such as limestone, chalk, marble, &c. In burning or converting these substances into lime, they are deprived of their carbonic acid or fixed air; but, on cooling, begin to absorb it again from the surrounding atmosphere.

Lime, when in the state of a carbonate, is frequently termed *effete lime*. See *Lime*.

CARBONIC-*Acid*, a name given by modern chemists to an acid that prevails in great abundance in nature, and is mostly found in the form of an aëriform fluid or gas. It has received this title from its being constituted of oxygen, and a basis of carbon or pure charcoal. It is met with in the several states of gas mixture and combination. In the first, in a great number of subterraneous cavities; in the atmosphere, of which it occupies one-hundredth part; and it is frequently generated and disengaged during the change and decomposition of vegetable and animal matter. Secondly, in many mineral waters, which, from the peculiar taste communicated to them by this acid, are termed acidulous mineral waters. And lastly, as combined in lime-stone, chalk,

marble, and other substances of the calcareous kind, from which it may be procured by decomposing them by means of acids, or by fire. Upon the presence or absence of this acid also depends the mildness or causticity of calcareous earths, and alkalis.

When an acid is poured upon common calcareous earth, or other substances of that kind, it combines with the calcareous matter, and forms new saline compounds; and the carbonic acid is disengaged, and, uniting with caloric or the matter of heat, escapes in the state of a colourless gas, which is termed *carbonic acid gas*. This gas changes the blue juices of vegetables red. Its specific gravity to that of the atmosphere is about $1\frac{1}{2}$ to 1. A cubic inch weighs 0.68985 of a grain. Animals die in it in a very short space of time, and flame is instantly extinguished. It readily combines with water.

The author of Phytologia remarks, that when vegetable substances are decomposed by fermentation, there is a quick union of oxygen and carbon; and this carbonic acid gas, called formerly fixed air, rises up in vapour, and flies away. But where this process goes on more slowly, as in a dunghill lately turned over, or in black garden-mould lately turned over, and thus exposed to the air; much of which remains in the cells or cavities of the hot-bed or border; this carbonic acid is slowly produced, and is absorbed by vegetable roots, he supposes, in its fluid state, or dissolved in water, before it acquires so much heat as to rise in the atmosphere in the form of gas. This carbonic gas, in its fluid state, says he, or dissolved in water, not in its aërial or gasseous state, is the principal food of plants; because their solid fibres consist principally of carbon, and their fluids of water, as is evident from their analysis.

Carbonic *Earth*, that sort of earth or soil in which there is a considerable portion of decayed vegetable matter. Boggy and other wet kinds of lands, where any coarse vegetable productions have been suffered annually to become putrid, are mostly of this kind. And likewise such grounds as have been much enriched by manures.

CARCASE, a term given to the body of the horse and of some other animals. The carcase of a horse ought not to be too small and slender; as a small carcased horse is generally weak. On the other hand, a very large carcased horse proves often heavy and inactive; and when he happens to be under-limbed, it is reckoned a great fault, though this remark often fails; as horses that have been reckoned very much under-limbed have proved as strong, and fully as serviceable, as others.

It always shows strength in a horse, when his carcase is of a moderate size, his ribs large and well-arched, his flanks not hollow but smooth and full, with a straight back, or but a very little sinking—his hinder parts, or uppermost haunches, not rising higher than his shoulders.

CARDOON, a term applied in some places to a kind of wild artichoke, propagated only by its seed, which is of an oval form, about as big as a grain of wheat, of a very dark green or blackish colour, and marked with black streaks, from one end to the other. This plant is more deserving of being cultivated in the garden than the field, as it has not yet been employed as an article of food for any sort of live-stock.

CARLICK, a provincial term, applied in some places to charlock. See *Charlock*.

CARNATION-GRASS, in *agriculture*, a term applied to some tussocky sorts of grasses, as air-grass, probably from their having this kind of colour in their flowers.

CARPET-WAY, a green plat, or path, left unploughed up in an arable field.

CARRIAGE, a general name applied to carts, waggons, and other vehicles, employed in conveying timber, corn, persons, &c. from one place to another.

Carriage, in irrigation, is a sort of conduit, made of timber or brick; if the latter, an arch is turned over the stream that runs under it, and the sides bricked up; if the former, which it commonly is, it is constructed with a bottom and two sides, as wide and as high as the main it lies in. It must be made very strong, close, and well jointed. Its use is to convey the water in one main over another which runs at right angles with it; its depth and breadth are of the same dimensions with the main it belongs to; its length is in proportion to the breadth of the main it crosses. Wherever it is necessary, it is the most expensive conveyance belonging to the watering of land.

Carriage-*Drain*, a furrow, or trench, for the conveying of water to overflow and improve meadow-land. Drains of this kind are distinguished into two sorts;—the main carriage, which should be made with a convenient descent; and the lesser carriage, which should be shallow, and as many in number as possible.

Carriage *Track*, a sort of road made in tracks, for the wheels and horses. See *Road*.

CARROT, the name of a large tap-rooted plant well known and much used in the feeding of animals.

It is observed by the author of a late practical work, that "though this valuable root has been cultivated in a local manner for a great length of time in this country, it is only within the last ten or fifteen years that it has been much applied to the purpose of feeding live-stock by the farmer. It would seem to have been introduced into the southern parts of the island from the Low-countries, where its culture and use as food for horses had been long known and practised."

And it is likewise added, that "although there are many varieties of the common carrot, there seems to be only one that is proper for being cultivated in the field for the purpose of feeding animals. This is the sort usually termed the *orange carrot*, in which the colour is much more dark than in the other varieties, and the flesh more saccharine and juicy. The root of this variety mostly rises to

nearly double the size of that of the pale yellow kind."

This sort of crop may probably be cultivated to the greatest advantage on warm, light, loamy, or sandy soils, and generally succeeds best when sown after barley.

It has been remarked by the writer just noticed, that "the soils on which crops of this root succeed to the greatest advantage are, those which have considerable depth of fine mould, either of the friable, loamy, sandy, or vegetable earthy, kinds; but they may probably be cultivated to advantage on most sorts, except those of the stiff clayey and thin gravelly or chalky descriptions. The black deep vegetable, and the rich deep sandy, soils, appear however, he says, the best calculated for this sort of crop, as well as most other kinds: and the medium sands and sandy loams stand next, as best adapted to its culture."

But on whatever sort of soil it may be grown, or after whatever kind of crop, the land should always be ploughed as deep as possible in October, a second time in February, and a third in March, which is the most proper season for sowing the seed. By ploughing the land deep in October, two useful purposes are served: the new soil is exposed to the influence of the winter frosts, by which it is mellowed, and rendered more fit for nourishing the plants; and the roots of the carrots are enabled with more freedom to push downwards, a circumstance of considerable importance in the carrot-husbandry; for, if the roots meet with any obstruction in getting down, they are liable to grow forked, and throw out lateral roots, by which the crop is very materially injured.

It has been suggested, that "this deep tillage may be perfectly accomplished either by means of the trench-plough following the common one, or by the common one alone, with a good strength of team; but the former method is to be preferred, wherever the lands are inclined to be stiff or heavy. Three ploughings are mostly found sufficient, where the land has been previously in a state of tillage; but more may in other cases be necessary. The first ploughing should be made to the depth of ten, twelve, or fourteen inches, and be performed when the soil is tolerably dry, about the beginning of October. It may remain in this condition till towards the middle of February, when it should be turned over a second time, but in a cross direction, to nearly the same depths. In March, a third ploughing may be given, in order to the putting in of the seed. This may be somewhat lighter than the preceding ones." And it is added, that "at the last ploughing, a suitable proportion of well-rotted farmyard dung should constantly be turned into the soil; as it has been fully shewn, by various trials detailed in the Annals of Agriculture, and other books on husbandry, that, though good crops of carrots may be occasionally grown without the use of manure, it is only by the liberal application of that substance that the greatest produce possible can be obtained, as they are in general found to bear a relative proportion to the quantity that may have been employed."

As soon as the last ploughing has been given in March, the land should be harrowed, and the surface made as fine as possible; after which five pounds of seed should be sown on the acre, and harrowed in very gently; or, when drilled, two pounds.

It has been properly remarked, that "the cultivator of carrot-crops should always be careful in saving his own seed, by selecting annually some of the most perfect and best-shaped roots of the preceding year's growth, to be set out separately about the beginning or middle of March, in an open piece of ground, for the purpose. The seed will be ready about August. By this means, the agricultor will always be in possession of such new or fresh seed as may be depended upon, which is seldom the case when purchased; old and imperfectly ripened seed being frequently blended with the new, by which the crops often either wholly fail, or come up in a very imperfect and unequal manner. Besides, seed of the pale yellow kind, or what is termed the horn-carrot, a sort often cultivated in the Low-countries and in France, but which, as has been observed, does not grow to any thing near the size of the deep orange kind, is often disposed of to the cultivators of this vegetable."

As the seeds of carrots are apt to cling close together, it is impossible to sow them with any regularity, without adopting some method of separating them before they are put into the ground. The best way is probably to mix them with a quantity of bran, or dry sand, and then rub the whole well together. By this means the seeds will not only be disengaged from each other, but the seedsman be enabled to scatter them with greater regularity over the ground.

It has been stated however, that "some cultivators think that it may be sown more evenly without any of these matters being incorporated with it, by only being well rubbed and passed through a sieve, to separate it perfectly, after having been well dried in the sun."

It is observed in the work mentioned above, "that the most common practice in putting carrot-crops into the ground is, that of the hand or broadcast method, the seed being dispersed as evenly as possible over the land, after the surface has been reduced to a very fine state of pulverisation by harrowing, in order to provide a suitable bed for it to vegetate in; being then covered in by means of a light harrow. As the seed of the carrot is not of a nature to be deposited with much regularity by the drill, and as the young plants can be easily set out to proper distances in the operation of hoeing, this is probably the most appropriate method of putting such sort of seed into the ground. And an additional proof of it is indeed found, in its being that which is almost universally adopted in those districts where carrot-husbandry is practised to the greatest extent." But "with the view of having the after-culture of the crops more perfectly performed, and at the same time to save the great expense of hand-labour in

hoeing the crop, the drill method has been attempted by some cultivators, but we believe without complete success. The work is finished in equi-distant rows at the distance of from twelve to fifteen or eighteen inches from each other, according to the mode of hoeing that is practised. In this business some cultivators do not make use of drill-machines, but strike the land into small furrows by hoes or other implements contrived for the purpose, and then cast the seed over the ground by the hand, covering it in either by slight harrowing, or hoeing in the tops of the ridglets." It is added, that "in this method, where a drill-machine is used, it has been advised by an intelligent cultivator to deposit the seed to the depth of one inch in the rows, leaving the spaces of fourteen inches between them as intervals; the seed in these cases being previously steeped in rain-water for twenty-four hours, and left to sprout, after which it is mixed with saw-dust and dry mould, in the proportion of one peck and a half of each to a pound of the seed. The land is afterwards lightly harrowed over once in a place. Two pounds of seed in this mode is found, as has been observed, sufficient for an acre of land."

This kind of crop should always be hoed three times in the season. The first time, as soon as the plants can be distinguished from the weeds, which surround them; which should be done with three-inch hoes, having handles not above two feet in length. It is an operation that requires to be performed with great attention, as it is extremely difficult to distinguish and separate the young carrots from the weeds. The second hoeing should be given in three or four weeks afterwards, according to the forwardness of the crop. It may be performed with common hoes, care being taken to set out the plants at proper distances. From eight to fifteen or eighteen inches, each way, is the common distance at which they are allowed to stand: and it has been proved, from many years' experience, in districts where they are most cultivated, that carrots which grow at such distances always prove a more abundant crop than when the plants are allowed to stand closer together. The third hoeing is commonly made about the middle or end of June: and in this, besides destroying the weeds, another material circumstance to be attended to is, to set out the carrots at proper distances, and also, wherever any have been left double at the former hoeings, to take the worst of the two plants away.

In Suffolk the farmers sow them after turnips, summer-land barley, and peas set upon a rye-grass lay; the crops upon the first have generally been most productive; next to that they prefer the latter. In the first place they feed off the turnips by the beginning of February, and then lay the land up on small balks or furrows, in which state it remains till the second week in March, when it is harrowed down, double-furrowed to the depth of about twelve inches, and the seed sown thereon, at the rate of four pounds and a half to the acre. As soon as the plants appear distinctly, they are set out with a small hoe, at the distance of six inches from each other; they are afterwards hoed twice more at different times, according as the crop seems to require it: and it is not unusual to harrow them between the hoeings, which does no injury to the root, and frequently saves the expense of a third hoeing.

When carrots are intended to be sown after peas, they usually plough the stubble as soon as the harvest is over, in order that the land may clear itself of weeds; in December, it is laid up in small balks to receive the benefit of the frosts; in February, it is harrowed down, and manured at the rate of fifteen loads per acre; the manure is ploughed in to the depth of about four inches, and in the month of March the land is double-furrowed, and the seed sown. By pursuing this method, they say, the manure lies in the centre of the soil, and not only affords nourishment and support to the carrot in its perpendicular progress, but renders it easy to be turned up by a single ploughing, and greatly promotes the growth of the succeeding crop of barley.

In Norfolk, it is the practice to sow carrots after a crop of turnips. The manure, after being put on the land in the beginning of March, is first ploughed in with a common plough, and afterwards trench-ploughed about fourteen or fifteen inches deep; it is then harrowed very fine, and the seed sown about the middle of March, though the latter end of that month is probably better, as the plants come up nearly as soon as the early sown, and are attended with fewer weeds. The carrots are generally ready to hoe in the beginning of May; and, when tolerably free from weeds, may be hoed with large hoes. Carrots are also frequently grown with the same preparations on land where potatoes have grown. The manner in which Mr. Billing cultivated his land for these plants is the following: The wheat and clover-stubbles he split down with the plough early in the preceding November; and is satisfied, that whether the wheat-stubble be, as it is called in Norfolk, flat-work, or in ridges, or the carrots are to be sown after clover or rye-grass, the land cannot be ploughed too early, so that the frost and snow may have their full effect in mellowing the ground for the reception of so small a seed; and this is the more necessary to be attended to, the stiffer and tougher the soil is. He ploughs the wheat and clover-stubble three times, but the land on which the turnips have been, but twice; the first shallow, but the last as deep as the staple of the ground will permit; and on this ploughing the carrots are sown.

Sometimes the land is immediately dunged for the carrots; but, at other times, only for the previous crop: the former is probably the better method. Mr. Billing thinks four pounds of seed an acre is sufficient.

It is generally three weeks after sowing, and sometimes longer, before the carrots appear; and they are frequently seven or eight weeks before they are fit for the hoe, which affords the weeds an opportunity to get strength in this season, as they grow fast. Mr. Billing is therefore of opinion, that it is better to sow them as late as you can, with safety to the crop, as he found those sown in April, on clover-

stubble, came much the soonest to the hoe, though later sown.

Where the crop of carrots is very clean, one hoeing may be sufficient, but, where the weeds are strong, it is necessary to hoe them a second time; but, about ten days or a fortnight after the first hoeing, they should be harrowed: this will displace the weeds, and prevent their growing again, which many of them will, probably, otherwise do, especially if it be showery weather. The harrowing does not hurt the carrot-plants, but, on the contrary, does them service, by bringing fresh earth to them, as well as by destroying the weeds. About three weeks after harrowing, in case it has not perfectly cleared the ground of weeds, or in case new weeds spring up, Mr. Billing hoes the carrots a second time; and after this, if there still remain any weeds, which will be the case if much rain falls during the time of the second hoeing, a second harrowing is bestowed. But where the weather has been favourable, and those employed in hoeing have done their duty, the carrots once hoed and harrowed have been as clean as those on which two hoeings, and as many harrowings have been practised.

An Essex farmer remarks, that carrots will amply repay every expense of the finest culture; and should, from their extensive utility, on sound, deep, and friable land, be every where attempted. He sows in March or April; hoes three times, and harrows after each hoeing.

The expense of cultivating this crop, on poor sandy land of five shillings an acre, as stated in the Report of Suffolk, is as follows:

	£.	s.	d.
One ploughing, deep - - - -	0	7	0
Seed and sowing - - - - -	0	4	6
Hoeing - - - - - -	1	1	0
Taking up, 1*s.* a load of forty bushels topped, that is, on two hundred	0	5	0
Carting home - - - - -	0	5	0
Rent, tythe, and rates - - -	0	7	0
	£.2	9	6

There are considerable doubts of the drill-culture being of great use in this crop, according to the accounts of the Suffolk farmers; but in the New Farmer's Calendar it is observed, that the horse-hoe will save an immensity of expense, besides affording to the roots the full benefit of the atmospheric manures. Mr. Amos's method is "two pounds of seed per acre. He steeps the seed in rain-water twenty-four hours, and lays it upon a floor, until speared. Mixes thoroughly, with three pecks dry saw-dust, and three pecks of fine dry mould. Drills one inch deep, and fourteen inches between the rows, with the same cups used for wheat or barley. Harrows once in a place. The plants appear in eight or ten days."

The first author further observes, that on expressing his surprise at seeing good long carrots grown in very shallow sands, to a person who had been many years bailiff to several estates, he told him he had been accustomed to obtain carrots of full length and size, in such land, by dibbling the seed to a great depth, with an iron dibber; and when it was objected, that the plants, from the seed being so deeply buried, would never get above the surface; he assured him, in his numerous trials, he never observed any such consequence. It is stated by a wrirer in the twenty-fourth volume of the Annals of Agriculture, that he sowed, broad-cast, two acres of carrots, following a potatoe-crop, on a light sandy loam of twenty shillings an acre. They were twice hoed, at thirteen shillings the two, in the manner of hoeing turnips; and in the course of the summer he mowed one-third of the tops twice; another third of the tops once; and the remaining third of the crop the scythe did not pass over. The tops were greedily devoured by his horses, cattle, and pigs, in the fold-yard; and were equal in quantity and value to a considerable crop of clover, cut and made use of in the same mode. At the end of October, he took up the carrot-roots, and preserved them in a trench in the manner of potatoes. The crop was full six hundred bushels per acre; and it was not found that the roots of those carrots whose tops had been twice cut were at all inferior in size or quality to those whose tops had been left untouched. A passage was left for a small cart to carry off the tops, and another he made by drawing the young carrots wanted for family use. He has reason to consider this mode of cultivating carrots equal to the best fallow-crop, provided the carrots are twice well hoed, and the tops are cut off, as the scythe prevents any weeds seeding in the autumn. His horses, oxen, milch cows, and pigs, are at this time eating the carrot-roots; his turkeys, and other poultry, have them boiled, and are fatted well upon them: even his pigeons are fed upon carrots, as they constantly attend in the fold-yard to pick up every particle that drops from the mouths of the cattle; which supply is sufficient to keep them at home, and to save an expense in feeding them during the severe weather.

The market price for carrots near his house, twelve miles east of York, is from ten-pence to one shilling per bushel; at which price, it must be allowed, he says, that the crop is a profitable one. He further observes, that the demand for carrots, in his neighbourhood, is become not inconsiderable for stallions; for it is found that this food is more invigorating aud fattening than any other that can be given to them.

Though it is a common practice with farmers, in Suffolk, to allow crops of carrots to remain in the ground all winter, it ought by no means to be generally recommended; as, besides the injury the crop may frequently sustain by severe frosts, the farmer must often experience great difficulty in getting up a sufficient quantity of roots for the supply of his live-stock, especially when the earth is bound up by frost, or covered with snow. On these grounds it is evident, that the best way of preserving carrots, during winter and spring, is to dig them up in the end of October, or beginning of November, when their green leaves are decayed, which is a common

practice in Leicestershire. In doing this, the best method is to make use of three-pronged forks, though spades are frequently used. By loosening the soil with either of these instruments, and drawing up the carrots, at the same time, by the top, the work is performed in a very expeditious manner. The carrots should be allowed to dry for a day or two on the field, before they are taken home. On being dug up when they are dry, the tops may be taken off, and given to the swine or cattle; and the roots be piled up in heaps in some close dry house, well covered up, either with straw or dry sand, so as to defend them from frost and dampness.

It is observed by an Essex farmer, that it is his practice to take them up on a dry day, put them directly into small upright cocks of ten bushels each, entirely covered, with the tops cut off; they thus appear to dry better than in any other mode; and, with very little loss, to bear the weather. If, after being thus dried, they are carried into any barn, or shed, it will be better, if in large quantities, through the hazard of heating, not to pack them close, but rather throw them promiscuously into heaps, with a little straw over them.

The distances "vary in practice from nine to eighteen inches, twelve being that most generally adopted. In the county of Suffolk, where carrot-husbandry is carried to a considerable degree of perfection, the most usual distance is fifteen or eighteen inches each way. And at these distances they have found, by long experience, that the crops are finer, and the roots larger, than when the plants are permitted to stand nearer to each other. The tops of the plants by these distances have likewise full room to distend themselves, and cover the surface of the soil, by which it is kept perfectly moist and mellow, and consequently in the best state for the nutrition of the plants, as well as for the roots swelling out to their full size." And "further hoeings may, it is observed, occasionally be requisite, of which the cultivator must judge; as it is of the greatest importance in this husbandry to keep the land well stirred, and the crops perfectly clean, their goodness materially depending upon such operations being duly performed."

And, "in the drill method, the intervals may be cleaned by a small light plough for the purpose, or the horse-hoe. Even when executed by the hand-hoe, before the plants appear, as has been practised by some cultivators, it may constitute an advantage in the drill method."

It is added, that "the expense of this business is different in different situations, according to the expertness of the persons employed, and the method in which the work is performed. The average expense of different experimenters in various soils and situations, as stated by the intelligent editor of the Annals of Agriculture, is 1*l.* 16*s.* the acre; but in Suffolk, where the culture is familiar, and the work of course executed with much facility and expedition, it only costs from 16*s.* to 18*s.* or a guinea the acre."

This sort of crop should always be taken up about "September or October, when the tops first begin to turn of a yellowish colour, and to lose their freshness. This point should be nicely attended to; as, if the work be delayed too long, much loss will be sustained, in the tops being considerably decreased in bulk, and rendered almost incapable of being consumed by swine or neat-cattle; and, when performed too early, the roots will not by any means keep so well." It has been observed, that "in taking up the crops two methods have been practised; those of raising the roots by means of the plough and the fork. The first is the most expeditious, but the roots are apt to be much broken; while by loosening the mould, by three-pronged forks of sufficient length, and at the same time drawing up the plants by the tops, they may be raised with great facility, and without sustaining injury. This method, though perhaps rather more expensive, ought in general to be adopted. After being raised from the ground, the roots should be suffered to remain in the field for two or three days, that they may become perfectly dry. With this intention they are sometimes piled up in small heaps or wads. When fully dry, the tops are cut off, and the roots packed up in heaps with dry straw, or, when in small quantities, with dry sand, in some dry close building, a good covering of the former being laid over them. This is the most secure method. But when the crops are extensive, they are sometimes built up in the field or other convenient place, in rows or ridges, at the distance of two feet from each other, tops outwards, with dry straw, to about four feet in height; the intervals being then stuffed, and the tops well covered over by it, sedge or some other similar material being applied by way of thatch. The outsides are also protected by straw, kept close by means of flakes or hurdles. In this mode, which can only be practised in very dry situations, there is great loss from the tops not being removed and eaten before they were put up. In dry situations they may, however, be well preserved without this trouble or expense, in sheds or other convenient places. But in whatever way they may be preserved, they should not be put up in too large quantities, or too closely together, as they are liable to be much injured by heating."

And it is added, that "the expense of taking carrots up must vary much with the goodness of the crop, the nature of the land, &c. The average of several trials on different kinds of soil, under different sorts of culture and management, and in different situations, has been calculated at 17*s.* 8*d.* the acre.

In many cases it will not, however, much exceed half the sum. Cleaning, topping, and carting, in the same trials, under similar circumstances, were found on the average to be 15*s.* 7*d.* the acre: the whole expense of procuring crops of this kind, in such cases, being in the proportion of six pounds four shillings and eleven pence the acre; or, in relation to the quantity of produce afforded, about two-pence three farthings the bushel."

In some trials of the Reverend Mr. Young, detailed in a late volume of the Annals of Agriculture, the expenses of cultivating carrot-crops stands much higher than the above.

And according to Mr. Arthur Young's account, in Suffolk, a medium crop may be reckoned at three

hundred and fifty bushels the acre, which, at sixpence the bushel, the price at which they are sold to be sent to the London markets, amounts to 8*l.* 15*s.* the acre. Hence, though the hoeing and digging a crop of carrots may be attended with considerable expense, the above gross produce will amply repay, and leave a very handsome profit.

The uses to which this root is applied are various. Large quantities are sent to the London markets, and also given as food to different kinds of live-stock. Horses are remarkably fond of carrots; and it is even said, that when oats and carrots are given together, the horses leave the oats, and eat the carrots. The ordinary allowance is about 40 or 50*lbs.* a-day to each horse. Carrots, when mixed with chaff, that is, cut straw, and a little hay, without corn, keep horses in excellent condition for performing all kinds of ordinary labour. The farmers begin to feed their horses with carrots in December, and continue to give them chiefly that kind of provender till the beginning or middle of May; to which period, with proper care, carrots may be preserved. As many of the farmers in that county are of opinion that carrots are not so good for horses in winter as in spring, they give only half the above allowance of carrots at first, and add a little corn for a few weeks after they begin to use carrots.

The result of the inquiries made by the author of the Agricultural Survey of Suffolk, is that they give———

At Sutton, six horses two loads a week; no corn; and eat little hay.

At Shottisham, six horses one load a week, with corn; in the spring two loads, without corn; eat little hay.

At Ramsholt, six horses seventy-two bushels a week; no oats; and half the hay saved.

At Alderton, six horses forty-two bushels a week; oats given; and saving of hay not considerable. At Alderton, oats given because not carrots enough.

At Hollesley, six horses two loads a week; no corn; more than a fourth of the hay saved.

At Capel, six horses one load a week; no corn; save more than half the hay.

Upon reviewing these circumstances, says the writer, it appears that two loads a week are a very large allowance, probably more than are necessary; seeing that with seventy-two bushels at one place, which is one and three quarters, and one load at another, all the corn is saved: let us therefore decide, that when six horses eat eighty bushels of carrots a week, which is thirteen bushels a week for one horse, they want no corn whatever, and will eat only half the hay of corn-fed ones. This will enable us to ascertain the value tolerably, though not exactly, because we do not know what would be the fair allowance of oats to balance such feeding with carrots. The whole turn of the intelligence he received ran upon the vast superiority of condition in which horses are kept by carrots, to that which is the result of corn-feeding; for this evident reason, carrots are given nearly, if not quite, in as large quantities as the horses will eat: but oats are never given in such a manner, they are always portioned out in an allowance very far short of such plenty. A quarter and a half of oats would, he is persuaded, from the general turn of every man's conversation, be inferior to two loads of carrots: this, at 20*s.* is 1*l.* 10*s*: there is to be added the saving of half the hay, which may be called ten pounds per horse a day, or seventy pounds per week, which, at 50*s.* a ton, is 1*s.* 4*d.* per horse, and 8*s.* for six: which added to 1*l.* 10*s.* for corn, makes in all 1*l.* 18*s.* against eighty bushels, or 19*s.* a load: and that this is a moderate calculation, appears from the decided preference given by several farmers in favour of carrots at 15*s.* a load, against oats at 20*s.* a quarter, not reckoning the carrots by any arbitrary estimation, but supposing themselves forced to buy the one or the other. The prime cost is calculated at 7*s.* a load: and that this is fair, will, he thinks, appear by the following articles:

	£.	s.	d.
Rent, tythe, and poor-rates -	0	15	0
Ploughing - - -	0	7	0
Harrowing, &c. - -	0	1	0
Seed, and sowing - -	0	6	0
Hoeing - - -	0	18	0
Taking-up ten loads, at 1*s.* 2*d.* -	0	11	8
	£.2	18	8

The tenth of which is 5*s.* 10*d.* or, per bushel, one penny three farthings; call it, however, 2*d.* per bushel, or 6*s.* 8*d.* per load; and if, to square with one article of intelligence, it is made 7*s.* it will not amount to two-pence farthing the bushel: here, therefore, says he, another view opens upon us, which is the farmer's profit: the carrots are worth, in feeding his team, 15*s.* but they cost him only 7*s.*; he has therefore the advantage of 8*s.* a load as the grower, on all his horses consume, and on an average of 4*l.* an acre.

Another way by which a friend of his, he says, made his calculation, was this:—at one load and a half of carrots, nine loads, a moderate acre, last six horses six weeks. He was inclined to think, from the intelligence, that one load and a half ought to be esteemed the proper quantity, and save six quarters of oats, which, at 20*s.* is - - £.6 0 0

Three cwt. and a half of hay a week saved: 21 cwt. at 2*s.* 6*d.* -	2	12	6
	£.8	12	6
The carrots may cost - -	3	3	0
Farmer's profit per acre, by feeding horses - - - - - -	5	9	6

It admits of various calculations, says the writer; but, view it in any light you please, the result is nearly, though not exactly, the same. Two facts result, he thinks, most clearly from the intelligence:—that horses will do upon them as well as upon oats; and that this application will not only pay the charges of

culture, but leave a profit nearly as great as the gross produce of a common crop of wheat. No wonder, therefore, the farmers cultivate them for their own use alone, without any view to a sale. It should farther be remarked, he says, that this result takes place, not in a district where the horses are poor mean animals that betray a want of good food, but, on the contrary, amongst the most useful teams that are to be found in England; and that these teams are fattest, and in the highest condition, when they are supported by carrots. No greater proof of the excelleney of the food can be wished for, than the horses going through the barley-sowing upon it, and the root doing better at that season of hard labour than earlier in the winter: this seems to speak the heartiness as well as wholesomeness of the food. One conclusion very naturally arises from this part of the intelligence, that the crop, or a considerable part of it, ought to be taken up in autumn, and packed in a barn; in which they would much sooner lose their juiciness, and acquire that more withered state, in which they are found to yield the best nourishment for animals.

But the author of the New Farmer's Calendar, who says he has given carrots to horses of every description, and that the practice is perfectly familiar to him, observes, that neither cart nor saddle-horses, although they will perform very well whilst fed with carrots, are able to go through so much labour, or to do it with so much ease or safety to themselves, as when they are allowed corn: and the only proper application of carrots to horses is sueh as either do not work at all, or very moderately; but, should the carrots be substituted for hay instead of eorn, it makes a very material difference in the question, and in many cases such a dispensation might be advantageous in all points. If a man can maintain his eart-horses in good working order and good health, as many really do, upon these roots instead of oats, he has nothing farther to say, except in praise of his economy; he only insists, that the very severe labour which he has been accustomed to see horses go through could not be endured without corn; and that he has known horses absolutely ruined by working them upon carrots, when the labour was by no means hard enough to have injured them had they been properly fed with corn. He has little to seek on this subject, since he has himself sufficiently often ridden and driven horses carrot-fed, watching their daily condition, and marking even the dew upon their eoats, the heaving of their flanks, and the comparative tone of their muscular exertions. This writer's opinion, however, seems chiefly to rest upon their being a laxative, and consequently debilitating food, which is probably not the case when they are taken up and kept in a dry place.

Carrots have been used for fattening cattle with great success: some, indeed, think that this is the most advantageous way of applying them; and there cannot be any doubt but that they must be highly useful in this way, from the great quantity of saccharine matter they contain. They have also been long proved to be excellent food for milch cows in the spring: as they certainly give no bad taste to the milk or butter, while the quantity of both is greatly increased by their use.

Sheep have also been frequently fattened on this root in Suffolk; and from Mr. Young's aceount, who seems to have fully eonsidered the carrot-husbandry, a good erop will weigh eleven tons; which quantity, he supposes, will feed twenty wethers for one hundred days, in which space they will be completely fattened. In Norfolk, it is reckoned a good erop of turnips that will fatten eight wethers; so that it would seem that one acre of earrots will go as far in fattening sheep, as two acres and a half of turnips: which is a circumstance that deserves the farmer's attention in many situations.

This sort of roots have been found in various trials to be "highly relished by all sorts of cattle; store neat stoek are found to thrive well upon it; and when given to milch-cows, the quantity of both milk and butter is said to be greatly increased, without their flavour being in any way impaired; but it is suggested that crops of this nature ean perhaps only be employed in this way with profit under particular circumstances, as where there is not live-stock to be fattened."

And "in the fattening of sheep, they have been found in some districts to be particularly beneficial, one acre being supposed equal to two and a half of turnips" in Mr. Donaldson's opinion. It is likewise found, that "hogs readily become fat upon this food, when prepared by boiling; but when given in a raw state, it has not, in some trials, answered well, according to Mr. Young; though in others the animals have soon been made fat by it.

"In feeding working horses, they have saved much corn, without the animals sustaining any inconvenience; the general daily allowance being from forty to fifty pounds each horse. When joined with eut chaff and a little hay, they are found to keep the animals in proper condition for performing all the different purposes of farming labour. This sort of food is mostly begun to be given them towards Christmas, and continued till the latter end of April. It is supposed by some, that it is better for spring than winter use; they of course give a much smaller proportion at the latter season. This, it is suggested, is probably owing only to the root being more fresh and succulent, and of course requiring more dry food to be joined with it.

"Crops of this sort must obviously differ in value according to the way in which they are applied in their consumption: and this difference has been found in practice, to be from two-pence halfpenny to two shillings: but in general it may be from six-pence to eight-pence or ten-pence the bushel."

The results in different trials, in different applications, as stated by Mr. Young in the twenty-fifth volume of the Annals of Agriculture, are these:

Application.	*Value per bushel.*		
In feeding all sorts of cattle	£0	0	$2\frac{1}{2}$
The average in different ways	0	1	0
In fattening oxen	0	0	6
In fattening hogs, boiled	0	2	0
Used instead of oats for horses	0	0	6
In fattening hogs, raw	0	0	8
In fattening sheep	0	0	4

It has been suggested, by a late practical writer, that carrots, after being prepared by boiling, might probably be converted to the purposes of fattening different kinds of poultry with great advantage, as they are extremely fond of them; as parsnips have been found highly useful in this mode of application.

The first writer further states, that the expense of cultivating carrots exceeds that of turnips, by 1*l.* the acre. To counterbalance which, he says, the carrots are much more impenetrable to frost, if left in the ground to be taken up as wanted; that they are not subject to any distempers similar to that of the fly in turnips; and that they are sown at a season when they cannot suffer by drought: while, of late years, turnips have suffered so much in various ways, as to have subjected the farmers, particularly those of Norfolk and Suffolk, to very heavy losses. Besides, as carrots can be preserved with certainty to an advanced period of the spring, as April or May, when the fattening of cattle is more expensive than at any other season, the superiority of carrots over turnips must appear evident to every practical farmer. He further observes, that with all these advantages, it might naturally be expected that carrots should be more universally cultivated; and that the only reason why they are not, is, because their value is not ascertained, or made generally known. Some such reason as this would appear to be the cause why the cultivation of so valuable a crop should be confined to one particular district of the kingdom; which, without doubt, if it were commonly cultivated, would be the means of saving an immense consumption of oats, peas, and beans, which are at present given to horses and other animals. This sort of crop is likewise of great utility in the keeping of store-pigs; but they will not probably fatten them without the assistance of corn or milk.

It is further remarked, by the able writer of the Suffolk Report, that the next circumstance to be attended to is the advantage of the plant as a preparation for corn; all the minutes agree, says he, that the barley after them is good and clean: several persons were inclined to think it equal to that after turnips fed on the ground; but the fair result is evidently, that if carrots were so fed, the barley would be much superior; of this the intelligence will not permit us to doubt. It is, however, fair to observe, that they one and all declare for putting them in upon clean land, and in this course:—1. turnips; 2. barley; 3. carrots; 4. barley, &c.: from which it appears, that on these sandy soils they are not to be depended upon for cleaning them when foul with couch.

It has been proposed by Mr. Baker, in the Transactions of the Dublin Society, in order to render the large tops of carrots useful, to convert them into a sort of hay, by mowing them over while green and juicy, without wounding the heads of the roots, and afterwards drying them on the ground. In this way, two tons of fodder are said to have been produced from an acre of land. It is however observed, by a late writer, that from plants of this sort taking in part of their nourishment by their leaves, that if cut while perfectly green, much injury must be done to the growth of the roots; and that, independent of this, such a method must be uneconomical, from the great loss that must be sustained in rendering the tops dry and proper for being put together in stacks. It is a much less wasteful practice, he conceives, to take up such crops gradually, and make use of the tops in the feeding of hogs, or other animals.

And where it is thought necessary to wash the roots before they are made use of for animals, it may be performed with ease and expedition in the same manner as is directed for potatoes.

Mr. Young concludes this very interesting subject with earnestly calling on all persons who have sands, or light sandy loams, to determine to emancipate themselves from the chains in which prejudice or indolence has bound them; to cultivate this admirable root largely and vigorously; to give it the best soil they have; to plough very deep; to hoe with great spirit; and to banish corn from their stables, as a mere luxury and barren expense that ought to be extirpated; an effect that flows very fairly from the preference which the instinct of the four-footed inhabitant generally gives to carrots.

Wild Carrot, the name of a biennial weed common in pasture-grounds. It greatly resembles the cultivated carrot, of which indeed it is a species. This sort however differs from the cultivated kind in its roots, which are small and sticky. In both sorts, after they have done flowering, the umbels contract themselves into somewhat the shape of a small bird's-nest.

CARR, a sort of cart, made use of in some places for conveying light weights. An improved kind of carr, much employed in Leicestershire, for conveying dung and other similar matters upon land in an easy and expeditious way (a good horse being capable of drawing near a ton weight in it) is constructed on the following plan:—The diameter of the wheels in this carr is four feet; the length of the body the same; the width of the body three feet ten inches; the extent of the shafts ten feet. Rails are occasionally put on for the purpose of carrying turnips, or other roots of a similar kind. It is made by Mr. Hanford, of Hathern; and costs, when complete, 5*l.* 15*s.* 6*d.*; and, with an iron axle-tree, 6*l.* 16*s.* 6*d.*

The improved Irish Carr is another useful sort of carr, which was much recommended by the late Mr. Bakewell. It is observed, in the second volume of Communications to the Board of Agriculture, that its principal advantage consists in the facility with which it is loaded, from its lowness; and, when gateways and roads are narrow, much room being gained by having the wheels under the body of the cart. In such situations, this cart seems well calculated for carrying manure, especially on meadow or ploughed land; and for that purpose its wheels ought to have a flat bearing, and to be at least six inches in breadth. Another advantage of this carr is, that from its construction the wheels are necessarily cylindrical, at least they are not necessarily conical; and the facility of draught arising from this unobserved circumstance has probably been imputed to some other

part of the construction, as we find, by experiment, that the resistance to the cylindrical wheel is not increased, but diminished, by increasing the breadth and the flat bearing of its rim. The knowledge of this fact is of very great importance to the farmer, as well as to the waggoner, since, by this means, he may be enabled, in almost all seasons, to drive his broad-wheeled carts, &c. on his meadow or plough-grounds, when no narrow wheel can be used; the advantages of which are too well known to be here insisted on: but when the width of gateways, and the breadth of roads, will admit of the wheels being placed at the sides of the cart, without confining the width of its body, it will probably be more advantageous to have them sideways than under the cart. See *fig.* 5. *pl.* XIII.

CARSE, a term applied to such lands as lie in the hollows near large rivers or the sea, and have a deep rich soil.

CARSE-*Land*, such lands as are of the deep clayey loomy kind, and which are highly useful for most sorts of grain-crops.

CART, a vehicle constructed with two or more wheels, and drawn by one or more horses. It is employed for the purpose of conveying manure, hay, straw, grain, and various other articles which are connected with the farm. Carts are made of different forms and dimensions, according to the nature of the materials they are intended to carry, and the uses to which they are applied.

The chief object in the construction of carts should be to adapt the wheels and axle in such a manner, that the power may be applied in the most favourable direction, and that the carriage may move with the least possible force.

There can be little doubt but that carts must vary in their forms and modes of construction, according to the nature and situation of the roads, and many other local circumstances; but, for the purposes of farming, probably those of the single-horse kind are in general the most advantageous and useful.

It is observed, in the twenty-seventh volume of the Annals of Agriculture, by lord Robert Seymour, that the advantages of single-horse carts are, he believes, universally admitted, wherever they have been attentively compared with carriages of any other description. By his own observation he is led to think, that a horse, when he acts singly, will do half as much more work as when he acts in conjunction with another; that is to say, that two horses will, separately, do as much work as three conjunctively: this arises, he believes, in the first place, from the single horse being so near the load he draws; and, in the next place, from the point or line of draught being so much below his breast—it being usual to make the wheels of single-horse carts very low. A horse harnessed singly has nothing but his load to contend with; whereas, when he draws in conjunction with another, he is generally embarrassed by some difference of rate, the horse behind or before him being quicker or slower than himself; he is likewise frequently inconvenienced by the greater or lesser height of his neighbour: these considerations give, he conceives, a decided advantage to the sort of cart he is recommending. If any other is wanted, that of the very great ease with which a low cart is filled may be added; as a man may load it, with the help of a long-handled shovel or fork, by means of his hands only; whereas, in order to fill a higher cart, not only the man's back, but his arms and whole person must be exerted. To the use of single horses in draught he has heard no objection, unless it be the supposed necessity of additional drivers created by it: the fact however is, that it has no such effect; for horses once in the habit of going singly, will follow each other as uniformly and as steadily as they do when harnessed together; and accordingly we see, says he, on the most frequented roads in Ireland, men conducting three, four, or five, single-horse carts each, without any inconvenience to the passengers: such, likewise, is the case in this country, in which lime and coal are generally carried upon pack-horses. And he might likewise have added, the single-horse carts in some of the northern counties, where one man manages two or three, and sometimes more.

In a preceding volume of the same work, the editor is decidedly of the same opinion, which he clearly shows to be founded in truth, by entering into a variety of discussion in respect to the points in which they are preferable to tumbrils or waggons.

And Mr. Donaldson, in his View of the Present State of Husbandry in Great Britain, seems to think, that, for carrying on the ordinary operations of husbandry, carts drawn by two horses are greatly superior to large, cumbersome, unwieldy waggons, that require four or five or six horses to move them along. It has of late, says he, been a subject pretty much agitated, whether single-horse carts are not to as great a degree superior to those drawn by two horses as these have been represented to be to waggons. Single-horse carts are certainly loaded and unloaded with much less trouble, and are in every way more easily managed, especially when carrying out dung, or when used for doing any odd jobs on a farm. It has also been found, from long experience and the most attentive observation, that one horse, in a cart properly fitted to its size and strength, will draw, on any road, two-thirds of the load that two horses, drawing in a line, and of equal power, are capable of doing. The carters of the town of Falkirk, in Stirlingshire, for example, have long been famous for the great weights drawn by their carts. Before the navigable canal between the Forth and Clyde was made, the whole goods transported to and from Glasgow, and the ports upon the Forth, were drawn upon one and two-horse carts belonging to these carters; the most expert of whom have long given the preference to carts drawn by one horse, as they experience no difficulty in carrying upon a cart, drawn by a single horse, from Borrowstounness to Glasgow, a distance of upwards of thirty miles, and of indifferent road, from twenty to thirty-five hundred weight. It is, he observes, further worthy of remark, that at the great iron-work at Carron, the company engaged in it formerly made use of waggons and waggon-ways, to wheel their coals and other heavy articles upon; but have entirely laid aside the

use of them, and, on principles of economy, employed carters, with single-horse carts, to transport the heavy articles which they require.

In the Northumberland Reports it is likewise remarked, that single-horse carts are beoming more prevalent in several parts of that county; and that Mr. James Johnson, a common carrier at Hexham, has a horse, sixteen hands high, that commonly carries from Hexham to Newcastle 24 cwt. and 20 cwt. back again; and there are instances of his having carried 26 cwt. from Newcastle to Hexham, which is a very banky, heavy-pulling road. It is further noticed that the neatest, most useful, and best-contrived carts we know, are those made in many parts of the North-Riding of Yorkshire. The single-horse carts of this construction, used for carrying coals from the county of Durham into Yorkshire, are sixty inches long, thirty-six inches wide, and eighteen deep, hold twenty-four bushels of coals, when set round the sides with large ones and upheaped. A man or boy drives three of these, two of which are equal to the greatest quantity ever carried by three horses. Mr. Charge, of Newton, sends three of these carts for coals every day, which bring seventy-two bushels of coals, the distance twenty-six miles there and back, and is performed in twelve hours by one man:—The same gentleman's two-horse carts bring thirty-six bushels of the same coals.

And in the Survey of Cumberland the writer says, the advantages of single-horse carts are so well understood in this county, that we did not see any other used. Three single-horse carts are driven, without any difficulty, by a man or boy, or even women and girls.

The author of the Agricultural Report of Mid-Lothian observes, that the wheel-carriages employed in husbandry are only the close-cart and the corn-cart, both of a light construction, drawn by two horses, and of late by one. The large wains, or heavy four-horse waggons, employed in English husbandry, are reprobated there. Two horses in a cart are commonly loaded with 18 or 20 cwt. One horse draws still more easily 12 cwt.; even 21 cwt. is frequently put to a single horse; and 30 cwt. on good road is not uncommon. And that this cart has lately been much improved: placed on its axle, the bottom at each side projects over the inner head of the naves as far as nearly to touch the spokes of the wheels; from which acquired breadth the capacity is enlarged; while the side-standards, being brought nearer to a perpendicular, are able to sustain more weight. The dimensions are, length five feet three inches; breadth below, four feet; breadth above, four feet three inches; depth, one foot three inches; containing about a cubic yard. Price of a cart, painted, 1*l.* 15*s.* not including wheels, axle, or mounting, which may amount in all to seven or eight pounds more. The wheels are generally fifty-two inches high; the axle commonly of iron, from an idea, that, in the end, it is more economical to have them so; for it is not found in practice that iron axles are either more or less difficult to draw, although not half the thickness, than axles of wood.

It is remarked by lord Seymour, in the paper already mentioned, that the price of iron, cast into wheels, is 16*s.* per cwt. and the weight of each wheel about three quarters of a cwt. Two inconveniences only, he believes, have been found from the use of low cast-iron wheels; the first is, that cast-iron is very liable to breakage, upon concussion; the next is, that the course of a wheel of so small a diameter creates a very quick consumption of grease.—The first of these objections is in a degree removed by the ease with which the rim of the wheel is repaired by the application of worked iron, which being joined to it by a rivet, the wheel acquires some little elasticity, and thereby becomes perhaps stronger than when it was new. In order that the supply of grease may keep pace with the consumption, he has introduced four grooves, or cavities, in the boxes, increasing a little towards their centres; and, in order to defend the axle-tree, which consists of worked iron, against the harder body of the box, he has steeled the extremity of it.

By the author of the New Farmer's Calendar it is observed, that of the great saving to be made by one-horse carts there can be no doubt, since it has been experimentally proved, and was moreover easily to be discovered from just theory. More weight may be drawn by six horses, in so many carts, than by eight in a large waggon; and one man may manage two carts in the country. There are however, he thinks, some peculiar inconveniences attendant upon this plan, which are sufficiently obvious; and, says he, notwithstanding it has been, for years past, so warmly recommended by very powerful pens, it never has, nor probably ever will be, relished by the generality of farmers.

It has been suggested, by Mr. Young, in a late volume of the Annals of Agriculture, that ass-carts may be highly useful for various little purposes about a farm. A representation of the cart, with the manner of harnessing and yoking the animal in it, is likewise given.

For little uses about pleasure-grounds, these sorts of carts would also, probably, be found very convenient.

Close Cart, a term applied to all such carts as have no ladders, rails, or wings, attached to them, are so denominated. They are made close by boards, and mostly employed in conveying dung, gravel, earth, or such other materials as have considerable weight, in a small compass. By the application of wings or ladders to them, they are, however, frequently made to serve the double purpose of conveying heavy close matter, as well as those of a light bulky nature. See *pl.* XIII. *fig.* 6.

Corn Cart, is that sort of cart which is only placed occasionally on wheels, for carrying hay, corn in the straw, or other light bulky articles: carts of this kind are generally composed of standards, rods, and spars, without deals, but broader and much longer than the close cart, that they may

hold a more bulky load. They cost from 20*s.* to 30*s.* in Scotland, but in England they are considerably higher. See *pl.* XIII. *fig.* 7.

Coup Cart, is a cart of the close kind, so denominated from the body-part resting on a sort of frame, to which it is kept by means of staples, or other contrivances, through which a cast-bar, or wooden pin, is put, by which it is confined, and which can be readily removed when the load is to be either partially or wholly discharged. Carts of this sort are generally used in putting dung upon land. See *pl.* XIII. *fig.* 6.

Drag Cart, a sort of cart constructed with a drag, or some other contrivance, for checking or regulating the rapidity of their motion in going down hills or other declivities. An useful cart of this kind has lately been invented, or improved, by Lord Somerville; an account of which is given in the second volume of the Communications to the Board of Agriculture. In *pl.* XIII. *fig.* 1. is a perspective view of a cart, to be drawn by two strong oxen, by a pole, yoke, and bows, and to carry 45 cwt. In the front of this *figure* is represented the method which his lordship has contrived for adjusting the position of the centre of gravity of the load, to prevent its pressing too much on the cattle in going down hill; the front of the cart being elevated by means of a toothed rack, screwed to the front of the cart, and worked by a pinion and the handle *a*, immediately connected with the pole *e*.—By means of this pinion and rack, the front of the carriage is elevated more or less, in proportion to the declivity of the hill, by which means the weight of the load is made to bear more on the axis, and less on the necks of the oxen.—On the side-view of this cart is represented the manner of applying the friction-drag, which is made to press more or less on the side of the wheel, according to the steepness of the descent:—*bb* is the friction-bar, or drag; the one end of which is connected with the tail of the cart by a small chain, and the other end to the front, by means of a toothed-rack, *b d*, which catches on a staple in the front of the cart, by which the friction-bar may be made to press on the side of the wheel, more or less, at the discretion of the driver: the notches or teeth in this rack, it is observed, should be as close to each other as circumstances will permit. And in this representation, the friction-bar is, he remarks, applied lower upon the wheel than was at first proposed, in order to divide the pressure and friction more equally on the opposite sides of the wheel, so that the pressure on each is diminished, the risk of over-heating and destroying the friction-bars is also rendered less than if the whole pressure was applied in one point on the top of the wheel. The weight of the iron-work of this cart is 2 cwt. 20lb.

In *fig.* 2. *pl.* XIII. is a side-view of a cart of this kind, of smaller size, to carry 25 cwt. drawn by steers or small oxen, with the friction-drag, *bb*, out of use; and representing another and more simple method of adjusting the centre of gravity of the load to the declivity of the descent: *a b* is part of the arch of a circle, whose radius is nearly equal to its distance from the axis of the cart, and having several holes in it, through which a strong iron pin is put, to keep the body of the cart at any desired inclination with the pole.—*c*, a small chain to prevent the body of the cart being thrown too far back, through the carelessness of the driver, in adjusting it.—*dd*, the upper stage of the cart, for carryin bulky loads.—The weight of iron to this cart is 1 cwt. 30lb.

The advantages of the friction-drag, and other contrivances in this neat light cart, according to the ingenious account of Mr. Cumming, contained in the same volume, are, 1st. the method, which is equally simple and expeditious, of adjusting the centre of gravity of the load, so as to have a proper bearing on the horses or cattle, in going down hill, the advantage of which must be obvious to every man of science, more especially with bulky loads, in which the centre of gravity lies high.

2dly, The method of applying friction to the side of the wheel, to regulate the motion of the carriage in going down hill (instead of locking the wheels), the advantages of which method appear to be as follow: namely, 1st, the pressure and degree of friction may, with great expedition, be adjusted to the steepness of the declivity, so that the carriage will neither press forward, nor require much exertion to make it follow the cattle. 2dly, The friction is so applied to the wheel, that a given pressure will have twice the effect in retarding the progress that it would have if immediately applied to the body of the carriage, or to the axis: and by applying the friction on both sides of the wheel, the risk of heating and destroying the friction-bar is much less than if the same degree of friction was applied in one place. 3dly, This apparatus is so conveniently placed, that it can be instantly applied or adjusted, without stopping the carriage, or exposing the driver to the same danger as in locking a wheel. And, 4thly, this useful contrivance, in which he says simplicity and ingenuity are so happily blended, will assume yet greater importance when applied to both the hind wheels of waggons, by which means the resistance may always be proportioned to the steepness of the descent, the tearing up of the road prevented, the unnecessary exertion of the cattle in drawing the locked carriage down hill avoided, the danger to which the driver is sometimes exposed in locking the waggon-wheel totally evaded, and the time now lost in locking and unlocking the wheel saved to the proprietor.

And in *pl.* XIII. *fig.* 3. and 4. are views of carts to be drawn by a single horse, by shafts. By an attentive comparison of those drawn by shafts, with those that are drawn by the yoke and bows, the superiority of the pole to the shafts, and the advantage of making the cattle to draw by the yoke, in preference to drawing by the forehead, become evident. When cattle draw by the shafts, says he, the one before the other, it is impossible for the driver to know that each exerts an equal force, so as to con-

tribute equally to the draught; but when they draw by the pole and yoke, the point of draught being in the middle of the yoke, when the beasts draw equally, the yoke will stand square with the pole, and the position of the yoke will always enable the driver to discover the defaulter, and to bring him to a proper exertion: it is this harmony of draught, and equality of exertion, that gives so great an advantage to drawing by the yoke, that it is scarcely possible to say what weight of load two good large oxen can draw on a level road. The powers of cattle drawing by the forehead, on lord Shannon's estate, are recorded by Mr. Young and Mr. Billingsley:—an ox of the late Mr. Tattersall, near Ely, drew four tons of wood on a level surface without apparent difficulty. What then, says he, might not be expected from the equal exertion of two such powerful animals, acting at the equal ends of the same yoke?

Hay Cart, the same as that made use of for corn. See *Corn-Cart*.

Quarry Cart, such sort of cart as is employed in quarries. Carts for this purpose are variously constructed, according to the nature of the materials to be conveyed by them. When flat stones of great length and breadth are to be carted, they should be low, for the convenience of loading and unloading, and at the same time very firmly made.

It is observed, in the Agricultural Survey of the County of Perth, that Mr. Mylne, of Mylnfield, employs a cart of a particular construction in his quarry of Kingoodie, which merits the attention of those who have works of a similar nature. This cart has a bend in the axle, which brings it within fourteen inches of the ground, although moving on wheels more than five feet high. The ease with which it is drawn, loaded and unloaded, is superior to the common cart in the proportion of 7 to 3. See *pl.* XIII. *fig.* 8. He also uses in this quarry a cart for carrying very large stones, such as mill-stones, &c. which is drawn as easily upon wheels of two feet two inches in height, as upon wheels of a greater diameter. In this cart the axle is only about five feet long, so that the wheels run under the body of the frame, which is flat, and may be made of any breadth or length required.

Single Horse Cart, a term applied to that light sort of cart in which only one horse is employed. The term is made use of to distinguish them from those of the large kind, in which three, four, or even a greater number of horses are made use of. Carts of this small construction are extremely useful for all the various little purposes of cartage about the farm. See *fig.* 6.

Three-Wheel Cart, a term applied to such kind of cart as is constructed with three wheels, one being commonly placed in the middle before, and generally of a smaller size. Carts of this sort are mostly close, and used when great quantities of earthy or other materials are to be conveyed at once.

Cart-*Horse*, such as is employed in the draught of heavy carriages, and used in the business of husbandry: they are a breed of horses usually of the largest and coarsest description, probably brought from the low countries.

According to Mr. J. Lawrence, "a very erroneous idea has prevailed concerning cart-horses, which is, that provided they are big, heavy, and clumsy enough, all farther considerations are needless: on the contrary, it is, he thinks, both theoretically and practically true, that great abilities for draught must depend materially upon just proportion; and that four thorough-shaped horses will draw, with facility, a weight which would puzzle five ordinary ones, although of equal, or even superior size: a truth which they, he says, ought to reflect upon, who have a considerable number of those animals to maintain." He adds that "a capital cart-horse is not more than sixteen hands high, with a brisk sparkling eye, a light well-shaped head, and short pricked ears, full chest and shoulder, but somewhat forelow; that is to say, having his rump higher than his fore-hand; sufficient general length, but by no means leggy; large and swelling fillets, and flat bones; he should stand wide on all-fours, but widest behind; bending his knee well, and having a brisk and cocking walk.

"Short-legged, cloddy horses, as they are styled, are, he thinks, generally too sluggish and slow, subject to grease, and those disorders arising from a thick and sizy blood; but such are preferable to the loose, leggy, and weak-loined—the worst possible shapes of draught-horses. The breeds of cart-horses most in fashion in this island, at present, are, he says, the heavy blacks of the midland counties, the Suffolk punches, and those of Clydesdale in North Britain. The first are those capital sized, and high-priced horses made use of by the breweries and distilleries in London, and by the farmers of Berkshire and Hampshire, and a few other parts, where their teams form a considerable article of ostentation and parade. The second sort, or Suffolk punches, which also extend to Norfolk, are low horses, rather coarse-headed, with indifferent ears, in general chesnut (provincially sorrel), fore-low, with deep and large carcases, and nimble walkers, and trotters. They have ever proved themselves the truest and best drawers in the world, as well as the hardiest and most useful cart and plough horses. Their nimbleness, it should seem, is owing to their length and moderate size; and their immense powers in lifting weight, to the same cause, combined with the low position of the shoulder, which occasions the weight to be acted upon in a just and horizontal direction. Their superiority over all other horses, at drawing dead pulls, is no doubt, in some measure, owing to early training; as in no country is such pride taken, in teaching horses to draw; and it is well known, that a team of Suffolk horses, the signal being given, will all down upon their knees, and leave nothing behind them that is in the power of flesh and blood to draw away. As to draught-cattle, nothing need be done, but give those of Suffolk a fine head and ear, and flat legs; and we then are at the top of it." And he states, that "there is another breed of horses, in Suffolk and Norfolk (how they came there is somewhat difficult to ascertain), well fitted both for the saddle and

draught. A cart-horse of this description, bating a little coarseness of the head, was, he says, perhaps as fit to get hacks and hunters, from proper mares, as the best bred horse alive. A Norfolk farmer, about forty years ago, had a peculiar sort, which he styled his Brazil breed. This person would sometimes unharness one of his plough-horses, ride him to a neighbouring fair, and after winning a race with him, ride him home again in triumph." The Clydesdale horses, he says, according to Mr. Culley's description, "is probably as good and useful a draught-horse as any we are possessed of; they are larger than the Suffolk punches, being from fifteen to sixteen and half hands high, strong, hardy, and remarkably true pullers, a restive horse being rarely found amongst them In shape, in general plain made about the head, sides, and hind-legs; mostly grey or brown, said to have been produced from common Scotch mares, and Flanders horses, a hundred years ago." He adds that "the size, rather than the sort, of our cart-horses, has become the chief object of consideration, since it has been the custom to breed them up to a ton weight, and seventeen and even eighteen hands high." But he "asserts that these over-sized horses are not able to do more work than those of moderate size and true proportion: for in growing them up to this vast bulk, gain is only made in mass and weight to be carried; nothing in the size and substance of the sinews and muscles, the cords, levers, and pullies, which are destined to move their own, as well as any extraneous load. By this reasoning, it should seem, that the out-sized are unable to perform even so much work as the middling; and another argument against them, equally just, is, that they must, in general, consume a proportionally larger quantity of food."

Mr. Culley recommends to mix a little racing blood with the cart-stock.

The first of the above writers advises, that "in breaking the colt, it should always be brought to back readily, and to go quietly in the shafts. Every man," says he, "who has had much to do with cart-horses, well knows the abuse and the miseries they suffer, when they have not been taught to back; and also the trouble there is, in a press of business, where one horse will not go before or behind his fellow; whereas draught-horses should be all so far accustomed to change, as, at least, to make a decent shift in any place."

Cart-*Ladder*, a kind of rack, placed occasionally at the head and tail of a cart, to make it hold a larger quantity of hay, straw, &c.

Cart-*Lodge*, a small out-house for sheltering carts from the weather. Farmers should be very careful to place their carts, &c. under proper shelter, when out of use, as they will last much longer by this means than if left exposed in the yard to the effects of the weather; for, as they are thus sometimes wet, and sometimes dry, they soon rot, and become unfit for use. The dust and nastiness should also be constantly washed off before they are laid up.

Cart-*Rake*, a term used to signify the cart-track, or furrow made by the wheels of the cart.

Cart-*Rut*, a word used to signify the same with cart-rake.

Cart-*Sick*, a term used in some of the northern counties to signify the gutter or channel made by the wheels of the cart. It is sometimes written *Sink*.

Cart-*Wright*, a term signifying a person whose business it is to make carts, waggons, &c. generally called a wheel-wright.

CARTER, an inferior sort of farm-servant, who has the care of driving and foddering the team. They should always be chosen as steady, regular, and trusty as possible, and be perfectly gentle and humane in their disposition. It is of great importance to the farmer to have a carter with these qualifications.

CARRUCAGE, in *husbandry*, denotes the ploughing of ground, either ordinary, as for grain, hemp, flax; or extraordinary, as for woad, dyer's weed, rape-seed, &c.

CARRUSATE, a term that anciently denoted the quantity of arable land capable of being tilled in one year with one plough.

CARRYING, in *horsemanship*, is a term often used. A horse is said to carry low, when, having naturally an ill-shaped neck, he lowers his head too much. It is a fault that may be remedied by a proper bridle. A horse is said to carry well, when his neck is raised or arched, and he holds his head high and firm, without constraint.

Carrying *in the Wind*, in *horsemanship*, a term used to express such horses as frequently toss their noses as high as their ears, and do not carry handsomely.

CARUCA, a term used by some old writers for a plough. It is sometimes written *Carraca*.

CARUE, a term signifying sour. Thus to carue implies to grow sour, and is generally applied to cream.

CARUNCLE *of the Eye*, in *farriery*, the fleshy substance in the inner corner of the horse's eye, next the nose.

CASINGS, a provincial term, signifying dried cows' dung, which is used in several parts for fuel.

CASK, a vessel of capacity, for holding different sorts of liquids, or other matters.

CAST, a term applied to some kinds of insects. Thus a cast of bees signifies a swarm or flight of bees. See *Bees*.

Cast, a word sometimes applied to poultry, when they loose their feathers, or moult.

Cast, a term also applied to the changing of the hair and hoofs of horses. Horses cast or shed their hair at least once a year. Every spring they cast the winter coat, and take a summer one; and sometimes in the end of autumn they put on their winter hair, in case they have been ill fed, curried, or clothed, or kept in a cold stable. Sometimes they cast, likewise, their hoofs: when this happens, let them be turned out into a pasture.

CASTING, the operation of throwing a horse down. It is done as follows: Having brought him upon some even ground that is smooth and soft, or into the barn upon soft straw, take a long rope,

double it, and cast a knot a yard from the bow; put the bow about his neck, and the double rope betwixt his fore legs; about his hinder pasterns, and under his fetlocks: when you have done this, slip the ends of the rope underneath the bow of his neck, and draw them quick, and they will overthrow him; then make the ends fast, and hold down his head.

CASTING *a Colt*, a term which also implies a mare's proving abortive.

CASTRATION, in *farriery*, a term signifying, in regard to brute animals, the operation of gelding in males, and spaying in females. The operation may be performed at any age, but, in general, the earlier the better. See *Gelding* and *Spaying*.

CATARACT, in *farriery*, a disease in the eyes of horses, in which the crystalline humour is rendered opake, and whereby vision is variously impeded, or totally destroyed. The only certain method of cure in these complaints, is to remove the lens by means of extracting or couching.

CATARRH, in *farriery*, a sort of inflammatory cold in horses, in which there is an increased discharge of mucous matter from the internal membrane of the nose, throat, and lungs. It is to be removed by light feeding, and the use of tepid drinks; and, in some cases, by bleeding. Mr. White recommends a dose of febrifuge powder to be given every morning and evening, until the symptoms are mitigated, and then only every second or third day:

Take of nitre in powder one ounce; camphor, tartarised antimony, of each two drachms. Mix.

And clysters are also very useful at the beginning of the disease, and which, should the horses be constipated at any period of it, may be employed with advantage: the head, as well as the body, should be clothed, a large quantity of litter allowed, and hand-rubbing to the legs by no means neglected. If there be a discharge from the nose, it should be encouraged by steaming the head, as it is termed, that is, by putting a hot mash into the manger, and tying his head up to the rack, so that he may inhale the vapour. If at the same time the glands of the throat swell, and appear to be inflamed, the disease will probably prove to be the strangles, in which bleeding is generally improper; though, even in this case, should there be any symptom of fever, the operation must not be omitted.

A catarrh is sometimes accompanied with an inflammation and soreness of the throat, occasioning a difficulty in swallowing: in this case a blister is to be applied to the throat; and if the glands under the ears are swollen, let some discutient embrocation be applied to them, unless at the same time they feel unusually hot, and appear to be going on to suppuration, in which case a poultice is most effectual. When a cold is accompanied with an inflammation of the eyes, a rowel under the jaw is useful. A cold is sometimes attended with fever, and must be treated accordingly. When the horse loses his appetite, and the flanks work quicker than usual, there is danger of an inflammation of the lungs.

CATCH-*Land*, a name given to such common-field land as is not certainly known to which parish it belongs; and therefore the minister who first gets the tithes of it enjoys it for the year.

CATCH-*Work*, a term employed in the art of irrigation, to signify the practice of forming the works for throwing the water over such lands as lie in the declivities of hills.

CATCH-WORK *Meadow*, that sort of meadow which is formed by turning the water of a spring or small rivulet along the side of a hill or declivity, so as to water the lands between the cut or *main carriage*, and the original water-course, which in this case becomes the main drain.

"This," the writer of the Wiltshire Report says, "is sometimes done, in particular instances, merely by making the new cut level, and stopping it at the end; so that when it is full, the water may run out at the side, and flood the land below it. But, as the water would soon cease to run equally, for any great length, and would wash the land out in gutters, it has been found necessary to cut small parallel trenches or carriages, at distances of twenty or thirty feet, to catch the water again; and each of these being likewise stopped at its end, lets the water over its side, and distributes it till it is caught by the next, and so on over all the intermediate beds, to the main drain at the bottom of the meadow, which receives the water, and carries it on to water another meadow below: or, if it can be so contrived, another part of the same meadow, on a lower level." And in order "to draw the water out of these parallel trenches or carriages, and lay the intermediate beds dry, a narrow deep train crosses them at right angles, at about every nine or ten poles length, and leads from the main carriage at top to the main drain at the bottom of the meadow. When this meadow is to be watered, the ends of the carriages adjoining the cross-drains are stopped with turf, dug on the spot, and the water is thrown over as much of the meadow as it will *cover well* at a time, which the watermen call a *pitch of work*; and when it is necessary to lay this pitch dry, they take out the turfs, and let the water into the drains, and proceed to water another pitch."

It is seldom that this sort of watered meadow is expensive. The stream of water being usually small and manageable; few *hatches* are necessary: and the land lying on a declivity, much less manual labour is required to throw the water over it regularly, and especially to get it off again, than in other sorts of watered meadows. The expense of forming such meadow-lands is in general from about three to five pounds the acre; while the improvement is frequently from fifteen to forty shillings the acre, or more. And the usual charge for keeping up the works and watering the lands, which is mostly done by the acre, seldom comes so high as seven and sixpence. See *Irrigation and Watering of Land.*

CATERPILLAR, a general name for insects while they continue in their reptile or worm state.

It is observed by Mr. Hitt, in his Treatise on Fruit Trees, that there are two sorts or colours of

caterpillars which feed upon fruit-trees, the one black, and the other green. The black generally make their appearance in March, if the season be dry, upon the pear, apple, and several other trees. Sometimes great numbers of them are contained in a sort of web, and, if they are to be come at, should be taken off; for otherwise they will disperse themselves to all parts of the tree, and there feed upon the blossoms, leaves, or their buds, before they are unfolded. After they have lived some time in this active state, they generally conceal themselves in a bunch of leaves, or in a cavity of the rind of a tree, where many of their eggs are hatched the same summer, and become very destructive. There is also reason to think, that some of their eggs are preserved in those places during the winter, as many of them, and some in an animated state, have been found in old nail-holes, and under pieces of dead bark, during the month of February. The walls should, therefore, be well washed, and the dwarfs and standard trees well dressed and cleansed at that season.

The green caterpillars are never seen so early in the spring as the former; but are very prejudicial to both the young branches and fruit of the apricot, cherry, plum, apple, pear, currant, gooseberry, &c. They are never seen in great numbers together in a kel or web; but are generally found singly, wrapt up in the extremity of a new-made branch of the above-mentioned trees, or in a bunch of blossoms of an apple, pear, or cherry-tree, and sometimes on an apricot, with a leaf to cover them.

When the caterpillars are first perceived upon the wall or dwarf trees, whether before or after they are wrapt up, a brine, he says, should be prepared, and the trees gently swept all over with a brush or besom dipt in it. This will destroy many of the insects, by beating some off, and killing others. This work, he observes, should be often repeated, if there be a necessity for it, as there generally is in dry seasons. Perhaps a small engine would be the properest and most effectual instrument for this business. But gentlemen, who have leisure sufficient, may easily preserve their fruit-tress from the ravages of caterpillars, by carefully inspecting them every day in the spring; for it will easily be seen when a bunch of blossom-leaves, or young fruit, are joined together by a caterpillar; and, on the first discovery, the leaves are to be separated by the hand, and the caterpillars killed; this will save a young branch or bunch of fruit, which would otherwise have been certainly destroyed.

It is further remarked, that when standard trees are properly ordered by cutting and dressing, they will not be much subject to be infected with caterpillars; for, by taking off the old rind, and cleaning the cankered parts of those trees, many of the insects are destroyed, together with their eggs concealed in those places; and by keeping the branches thin and open, they are more easily shaken off by the winds.

Dr. Darwin observes, in his Phytologia, that in the late summer of 1799, the apple-blossoms in this country were much injured by a caterpillar, which ate the seed in the pericarp of each blossom, either before or at the time of its impregnation, the petals of the flower closing again over it and dying; and that though the leaves of many trees are renewed after having been totally destroyed, in the early part of the season by these insects, there follows an irremediable injury to the fruit.

It is likewise added, that as the ova of butterflies are deposited on the leaves of apple-trees and gooseberry-trees, as well as on the other parts—and, as these leaves fall on the ground, the eggs are thus covered and protected from the frosts, and the young caterpillars are believed afterwards to climb the trees in search of their food. If this be true, it would be an advantageous practice to rake together the leaves in orchards, and to burn them: which some have done from an idea, that the smoke thus produced was noxious to the eggs of insects deposited on the branches. Some gardeners, for this purpose, rear their gooseberry-trees on one stem only; and believe, that by tying a fringe round it, the insects, which are hatched in the soil, if such there be, cannot climb up the tree thus surrounded with a fringe; and as those caterpillars which are already on the tree let themselves down by a thread, when the tree is shaken, from the fear of being hurt by the vibrating twigs, if this thread be then broken, by moving a stick round under the tree, these insects cannot reascend.

A paper recently tarred on the outside might be wrapped round the stem of the tree, instead of the fringe, with perhaps more certain success; but the tar should not be smeared on the bark of the tree, lest it should injure or destroy it.

It may be further observed, that as there are two breeds of this insect in the year, the larvæ of the first breed devour the spring leaf, and the second the summer shoots. Where they deposit their eggs is not easily discovered, but, it may be conjectured, round the stem of the tree. It would, therefore, be of use to apply the brush and soap-suds: and if watered with soap-suds and the liquid of the dunghill, in spring, before the leaf appears, they might thus be prevented. When in a more advanced state, they are easily detected by their gnawing of the edges and under-part of leaves; and the only remedy is to pluck them off. All the leaves thus picked off should be carefully taken to a distance, and destroyed by fire or other similar means. If trees were sprinkled with the above fluids, it would probably preserve them from further depredation by these insects.

The ten-threaded caterpillar is eagerly sought after by birds, and is easily destroyed by man—but, if neglected, it deposits its eggs in great numbers about July, and they are soon hatched at this season, the young caterpillars issuing forth in swarms, and destroy the autumnal leaves. They deposit their eggs on the under-side of young leaves, where they may be seen in rows like little white specks. This is the proper time for picking off the infected leaves. Such bushes as have been much injured one year by caterpillars, are extremely liable to be attacked by them the succeeding ones.

As these insects are little affected by cold, the severe frosts of the winter-season probably only confining them so as to cause their destruction by the want of food, the best remedies are probably those of washing the trees with soap-suds and urine, and picking them off as much as possible.

Caterpillars not only destroy the leaves and blossoms of fruit-trees, but they also destroy cabbages, and other productions of the garden; and are generally the most prevalent in very dry seasons. By watering the plants frequently with such liquids as contain ammonia or volatile alkali, much advantage may often be gained, either from the effects of the liquor on the insects themselves, or by its rendering the growth of the plants so vigorous and rapid as to prevent them from being easily devoured.

CATKIN, a name given to such amentaceous flowers as consist of a great number of chaffy scales and flowers, dispersed along a slender thread-like receptacle, hanging downward, in the form of a rope or cat's tail, and is the male flower of the trees which produce them, as the birch, beech, pine, fir, poplar, walnut, hazel, &c.

CAT'S-FOOT, a term sometimes provincially applied to ground-ivy.

CAT'S-*Tail*, a term sometimes used to signify the round substances growing upon nut-trees. See *Catkin.*

CAT'S-TAIL *Grass*, a late coarse sort of grass, of which there are several different kinds. See *Phleum.*

Meadow CAT'S-TAIL *Grass*, a coarse late sort of grass, which has been cultivated in America under the title of Timothy grass. See *Phleum Pratense.*

CAT-*Whin*, a provincial term applied to the burnet rose.

CATTLE, a name generally applied to beasts of pasture, especially those of the *bos*, or the cow and ox kind. As cattle are highly advantageous to the breeders of them in different points of view, attention should always be paid to the rearing of them on all such farms as have a sufficiency of land of the pasture kind. And as no particular breed is suited to every situation, care should constantly be taken to adapt the breed to the peculiarity of the climate, soil, and situation of the farm.

There are many different breeds or varieties of cattle in this country; almost each district having its particular breed, which are chiefly denominated either from their appearances or the places in which they are found to prevail in the greatest perfection, as

The long-horned breed;
The middle-horned breed;
The short-horned breed;
The Welch breed;
The Suffolk Dun breed;
The polled or Galloway breed;
The Scotch breed; as the Highland or Kiloe breed; and
The Lowland, or Fifeshire breed;
The Alderney or French breed; and
The wild breed.

It is observed by Mr. Culley, in his Treatise on Live-Stock, that the *long-horned* or Lancashire breed of cattle are distinguished from others by the length of their horns, the thickness and firm texture of their hides, the length and closeness of their hair, the large size of their hoofs, and coarse, leathery, thick necks; that they are likewise deeper made in their fore-quarters, and lighter in their hind-quarters, than the other breeds in general. Mr. Donaldson says, that in size they are superior to th Suffolk duns, but inferior to the short and middle-horned breeds; and Mr. Culley thinks also that they are narrower in their shape, less in point of weight, than the short-horns, though better weighers in proportion to their size, and that the cows give considerably less milk, though it is said to afford more cream in proportion to the quantity.

They are more varied in colour than any of the other breeds; but whatever the colour be, they have generally a white streak along their back, which the breeders term *finched*, and mostly a white spot on the inside of the hough.

It is farther remarked by the same author, that many people contend that they are the native or original breed of this island. It is not easy, he says, to ascertain this matter; but if he may venture a conjecture, he thinks it is probable these have been the inhabitants of the open plain country; whilst the wild breed, or perhaps the Welch and Scotch, possessed the woody, wild, and mountainous parts of the island—However, says he, Lancashire at present, and for a long time past, has as much right to be called the mother-country for long-horned cattle, as Lincolnshire has to the large long-woolled sheep; for though all or most of the cheese-dairies in Cheshire, Gloucestershire, &c. and indeed the greatest part of the midland counties, employ a kind of long-horned cows, yet they are only a shabby mixed breed, much inferior in size and figure to the Lancashire breed, from whence it is very probable they all originated.

Mr. Donaldson, however, thinks it probable that the long-horned breed originated in importations of cattle from the neighbouring country of Ireland; and that bulls and cows brought from that island, having been coupled with the ancient breed of the district, produced the sort of cattle known by the name of the Lancashire or long-horned, and which now occupy a large portion of the pasture-lands of England.

But besides Lancashire, the long-horned cattle, says he, are also very general in the counties of Warwick, Leicester, Gloucester, Chester, and several others of the midland counties; and what is surprising, and shows great attention in the one instance, and equal neglect in the other, this sort of cattle are said to be found in greater perfection in the county of Leicester than in the district whence they take their name. This has arisen, according to the observations of the author of the Treatise on Live-stock, from the graziers of these counties buying their best bulls and heifers, for many years past, before the people of Lancashire were well aware of it. The former paid more attention to that kind

which was of a t.e mould or form, and quicker feeders; while the latter contented themselves with the old fashioned, large, big-boned kind, which are not only slower feeders, but, when fed, are not such good beef. In short, the little farmers in Lancashire, tempted by the high prices given them for their best stock, had lost their valuable breed before they were sensible of it.

This breed is understood by graziers to be in general rather slow feeders, except that particular kind selected and recommended by the late Mr. Bakewell, which are said to eat less food than the others, to become remarkably fat in a short space of time, and to lay their fat upon the most valuable parts, but have little tallow in them when killed; and, when used in the dairy, give very little milk. This variety also differs from the rest of the long-horned cattle, in having very fine, clean, small bones in their legs, and thin hides. They are a middle-sized, clean, small-boned, round-carcased, kindly-looking cattle.

In speaking of the improvement effected on this sort of cattle-stock by Mr. Bakewell, it is remarked by Mr. Lawrence, that "many years before, Sir Thomas Glasby had selected from Lancashire and Westmoreland a herd of the best shaped cows. Certain descendants of these were afterwards purchased on the banks of the Trent, and introduced into Warwickshire, by Mr. Webster, of Canley, in that county, whence originated the celebrated Canley breed. The breed of the country were already long horned, but far inferior to those introduced by Mr. Webster. Bakewell commenced his operations with Canley cows, and a bull from Westmoreland, called Twopenny. After breeding in and in, with this stock, through a great number of descents, ever selecting individuals of the roundest form, and smallest bone, he attained the desired success in those respects, and raised that variety which has been since so celebrated for aptitude to acquire external fat. But in the attainment of this end he sacrificed the quality of great milking, and rendered the animals less certain in the faculty of procreation. Hence the *Dishley* or *New Leicester* variety of long horns are calculated solely for the purpose of the grazier, the old breed retaining its superiority in the dairy." He adds that "there seems to be no opinion formed of any specific difference of quality between the flesh of these and the short-horned cattle; but if we are to judge by analogy of the hides and milk, we may reasonably attribute a more nutritious and substantial quality to the flesh of the former. It is usual to deem any presumed specific difference in the quality of the flesh of those animals on which we feed, as a groundless refinement, and to attribute every effect to the victuals on which they are fattened. Such idea, however, seems to be but another refinement. No keep will equalize the milk and hides, probably not the flesh, of distinct breeds; but we possess an unerring standard to determine of the former, whilst taste alone determines concerning the latter." And he says, that "the size of the improved long-horned stock of the midland counties is considerable, as appears by a four year old steer of Mr. Prinsep's breed, killed some years since, the weight of which was 248 stone, fourteen pounds to the stone, exclusive of twenty-five stone of fat. The hide weighed 177lb. It must be remembered, also, he says, there is a mellowness and ductility in the thick hides of well-bred stock, which much enhances their value at the leather-market."

He thinks that "the reality of the Bakewellian improvement of neat-cattle for the grazier's purpose, ought to be indubitable, from the vast prices given in the midland grazing districts, unprecedented in any other; this even after making considerable allowance for suspected jockeyship. Mr. Bakewell probably, he says, set the example of letting bulls and rams. His bull, Twopenny, before mentioned, covered at five guineas each cow, and he had many cows worth thirty guineas each. After a course of some years improvement, all his bulls were engaged for the season, from five to thirty guineas each, according to their form." He concludes by observing that Mr. Fowler, of Rolwright, in Oxfordshire, was the earliest and most successful disciple of Bakewell. And that he commenced his breeding career with two Canley cows, for which he engaged the bull Twopenny: the produce, two cows, which he named Long-horned Beauty and Old Nell. He had also, in 1778, a bull of Mr. Bakewell, called D, which was the sire of Shakspeare. Thenceforth he bred entirely from his own stock, the success of which is fully shown in the high prices obtained by auction for the cattle, at his well-known sale in 1791.

The Irish cattle, Mr. Culley thinks, are a mixed breed between the long-horns and the Welch or Scotch, but more inclined to the long-horns, though of less weight than those in England.

The *middle-horned* breed of cattle are most frequently met with in the south and south-west parts of England, as Sussex, Dorsetshire, Hampshire, Devonshire, &c. and have also reached so far north as Herefordshire, in which district perhaps the largest breed of this sort of cattle are to be found. The cattle of this breed that are met with in Devonshire are said by Mr. Culley to be found in the greatest purity, and of the best kind, in the vicinity of Barnstaple; these are of a high red colour, if they have any white spots, they reckon the breed impure, particularly if those spots run into one another, with a light dun ring round the eye, and the muzzle of the same colour; fine in the bone, clean in the neck, horns of a medium length bent upwards, thin faced and fine in the chaps, wide in the hips, a tolerable barrel, but rather flat on the sides, tail small and set on very high; they are thin-skinned, and silky in handling, feed at an early age, or arrive at maturity sooner than most other breeds; they are well fitted for draught, both as to hardiness and quick movement, and their shoulder-points are beautifully fitted for the collar.

But Lord Somerville, in a valuable paper on this sort of cattle in the Annals of Agriculture, says, speaking of the red or Devonshire variety, that "to describe the breed, not as they might be, in

imaginary individuals, but as they really are found, it may in general be observed, speaking of this, as of all other breeds, that conclusions must not be drawn from the shape and size of the bulls, but from the general quality of their stock. Certain it is, that, individually, handsomer bulls are often to be found in other breeds; and it is as certain, that this race, of which the whole produce is brought to view, stands the confessed favourite, or among the very first, at Smithfield, where prejudice cannot find the way. And in forming an estimate of merit or demerit, the annual produce is to be the object attended to; this in oxen, which for superiority of grain, activity in labour beyond all competition, and what in horses is termed blood, will be found a right criterion to judge of the bulls which got them.

"Beginning with the shape of the bull, in any very handsome individual, the horn is found, he says, neither drooping too low, nor rising too high, nor with points inverted, called here *stag-headed*; tapering at the points, and not too thick, or *goary*, at the root; the colour yellow, or waxy. The eye clear, bright, and prominent; looking well behind, and shewing much of the white:—a dead-eyed ox not often a good prover, or fine in skin:—an occasional variation of colour round it. Forehead flat, indented and small:—this found almost universally in this breed, and is a point that shews much blood. Cheek small, and muzzle fine:—if the forehead is fine, the muzzle is so too. The nose of a clear yellow, if possible like the horn, or mottled:—a black nose always to be avoided; for although occasionally a black-nosed ox may bear work, and die well, yet it is a point often demonstrative of a bad constitution, of such as turn scourers or *skinters* provincially, and particularly when the cast of the coat is of too pale a colour. The nostril high and open. In respect of throat, the bulls of this breed are sometimes reproached with being *throaty*, or with the skin too profuse and pendulous. The hair curled, giving an apparent coarseness to the head not to be found in the New Leicester bulls, when carefully trimmed with scissars. The neck perhaps thick, and goary, in the estimation of strangers, with which property the oxen of this breed are not to be reproached, or they would not labour as they do.

"Generally speaking, he thinks, the bulls are, relatively to oxen, not of a large size; and it should be observed, respecting size in general, that nature operating in food and climate, is imperious, and will produce oxen proportioned to those two circumstances in due course of time, whatever may have been originally the size of the bulls and cows.

"Here, he conceives, end the points wherein there is any essential difference between the bull and the ox; the variation in others is small and unessential: a remark which is, however, subject to limitation; for individual instances will occur, which, if too much attended to, would seem to establish a different rule.

"The neatness of form, and energy and vigour in labour, greatly, if not wholly, in this breed, arose from breeding by heifers, and year old and two year old bulls. Although an old ewe may produce a finer lamb than a younger one, yet the quality of vigour is unnecessary and extraneous to sheep. This is a prejudice deeply rooted in the minds of all practical men; although much, in the estimation of some, may be given to climate.

"Compared with the horse, the shoulder is, he supposes, low. It should correspond with the general thickness of the animal—on no account projecting. If a bullock is in-kneed, or bending inwards towards each other, the point of the toe must be out; the point of his shoulder must be the same; and he must be hollow behind the withers (an incorrigible point in an ox for feeding), and he must be, of necessity, a slow worker.

"The bosom is not sharp, with a loose, pendulous dewlap; but wide in form, and mellow in handling. In buying an ox, great notice should, he says, be taken of the breadth of the bosom, and between the fore-legs, standing quite wide, the legs like straight pillars supporting a great burden. Much in buying is lost or gained by attention to this point; it is not for symmetry only, but implies strength and speed; a proportionate breadth of breast giving wind: and here we find the application to a working ox.

"The legs are straight; and the more blood an ox shews, the smaller will they be. The circumstance of this breed shewing more blood than any other in the kingdom, has, he observes, been remarked by many persons ignorant of cattle, but deeply skilled in horses. The leg neither too long, nor too short: an undue length is to be avoided.

"Very much of a bullock's proof is, he says, admitted, on all hands, to depend on the size of the rib, rotundity of the barrel, and mellowness of the skin. These are the first points to handle, in a lean and in a fat ox. The two hind ribs should be bold, prominent, and widely independent of each other. The skin rising easily from the ribs, mellow, and elastic, affording room to lay fat on below it. A man buying a lean ox would do well to handle him on both sides; it often happens, that the frame or barrel is not equally round on both; one evidently to the eye and hand flatter than the other.

"The hips, or pins, lie so high as to be on a level with the back, either in a fat or lean state; by no means dropping. The older the animal, the lower the upper flank drops, and, consequently the higher the hips appear. In this point of the upper flank, a skilful judge will discover much of the inward properties of a fat bullock. The hind-quarters from the pin to the catch, or point of the rump, should be long and well filled up: handling the centre of this space is a leading feature in the estimation of choice judges, and ascertains more of the substantial quality of the flesh and fat of a beast, than the prominence of fat so much admired by bad judges on the catch of the rump.

"The setting on of the tail is on a level with the back, something elevated, nothing depressed: size

long, small, taper, and with a round bunch of hair at the bottom; the tail, as in a horse, denoting much of high blood.

"The gaskins are not too much cut away, nor, as in the Holderness breed, heavy and loaded; bearing always in mind, that these oxen are not bred for inactivity, but for wind, vigour, and strength: for although a breadth in the bosom, inasmuch as it is essential to wind, in a working animal, is beneficial; yet a load of flesh on this hind part tends nothing to activity; and, being of second-rate quality, is not desirable for profit.

"In point of skin, they are among the thinner classes, rather than the thicker. It is very rarely that an ox is found with a hard or wiry skin. Much depends on colour: the shades most admired are the mahogany; and the more glossy silkiness, if smooth, the better. Those with curled hair are deemed excellent provers, and a very glossy mahogany skin, paler or lighter, with curls like ripples of wind on a smooth mill-pond, is also in the highest estimation. It is hard to say which of these is the best; all turning out such numbers of good fat oxen. The paler shades, if the eye is clear and good, will bear hard work, and prove as well as any. This rule only is absolute, that a pale skin, hard under hand, with a dark and dead eye, too often denote a skinter in hard work, and rarely, under any indulgence, a good prover.

"Respecting the lower flank, and the cod, they do not, in his opinion, deserve that attention which many persons pay them, who consider these points of prime importance.

"The graziers like this breed, he adds, best at five years old. The worked-out steers of the vale sell for more, at five years, than at six: but six is the proper age. At eight, nine, and ten they are going back in all their points; and in their value after seven. No ox should be kept after seven, or, at most, after eight.

"They are, he says, yoked at two or three years old, and lightly worked—labour increased at four, from that period to six, full worked.—Worked oxen attain a larger size than unworked, finish their growth generally at six years old, but the larger size grow the longest." The practical experience of his Lordship shows that the "pole and yoke form the true lever of an ox, and he can draw a greater weight in yoke, than in collar and harness, particularly in a steep country.—The bullocks never come home in the middle of the day; a bundle of hay is carried into the field—all the calves of this breed are reared."

He adds, that "these oxen are not parted with by the tillage-farmers until the barley-sowing is over, and in many cases the turnip-ground once stirred, yet they are grazed fat, in six or eight months, to the average weight of forty-five score: those kept on after Christmas, fattened on hay alone, which in the grazing districts of the west is held equally nutritious with any sort of corn—oil-cake feeding not practised—these hay-fed oxen stand the drift to London, without waste. Instances of marsh-feeding heifers bought in April or May, quite poor, fit for the butcher by the middle of July; in August, uncommonly fine beef.

"The station of this breed begins, according to the observation of his Lordship, at Barnstaple, and is traced by pursuing the line of the river Taw, as high as Chumleigh, then to Tiverton on the Ex, Wellington, and nearly to Taunton. Then turning north, straight to the sea, over the eastern boundary of the Quantoc hills, to Stoke Courcy; from which place on the eastern extremity, to the mouth of the Barnstaple river on the western, includes the whole to the length of forty-five miles, and to the breadth, across from Tiverton to Minehead, of twenty-two. To the east of this range, the breed gets into a mixture of Gloucester, Welch, Upper Somerset, &c. being a varied dairy sample: and, more to the west, a Devon, verging on the principle of the Cornish stock. To the south, the variety of the south hams is found—coarse, with a good deal of white and brown, with black and white mixtures, of uncertain properties. Exmoor is the highest point of the district thus defined, the country shelving from it in every direction, the source of all the rivers, and the head-quarters of all the cattle. At Bampton and Wyveliscomb, they are found in great perfection."

Mr. Lawrence says, that "the red cattle of North Devon and Somerset are doubtless one of our original breeds, and one of those which has preserved most of its primitive form: the excellence of this form for labour is best proved, by the fact, that the fashionable substitution of horses has made no progress in the district of these cattle, by their high repute as feeders, and for the superior excellence of their beef, which has been acknowledged for ages."

He supposes that this breed runs to too great length of leg, crooked behind, or sickle-hammed, and is of insufficient general substance, and is apt to be in-kneed, that is, crooked in the fore-legs.

He conceives that, "by a proper selection from their own stock, they might be bred somewhat more square and substantial, without at all detracting from their delicacy, shew of blood, or speed. Their labouring powers might be thus increased, and their quantity of beef, without either debasing its fine qualities, or rendering necessary a larger portion of keep. These cattle have, he says, generally, for a century past, commanded the best price at Smithfield: but of late years the buyers there have shrewdly remarked, that although blood and fine form are very pleasing to the eye of the gentleman breeder, yet substance and weight are, and ever must be, the grand objects at market."

They are, he says, "the speediest working oxen in England, and will trot well in harness; in point of strength, they stand in the fourth or fifth class. They have a greater resemblance to deer than any other breed of neat-cattle. They are rather wide, than middle-horned, as they are sometimes called; some, however, have regular middle horns, that is, neither short nor long, turned upward and backward at the points. As milkers, they are so far inferior

to both the long and short-horns, namely, both in quantity and quality of milk, that they are certainly no objects for the regular dairy, however pleasing and convenient they may be in the private family way. Yet they have been formerly used with success at Epping, in Essex, in one or two instances; as a balance to which, they are universally rejected by the dairies of their own and the neighbouring counties. It is, however, rather an anomaly, that they do not produce greater quantities of milk, considering their form, the thinness of their skin, and the meagre and milky appearance of many of their heifers: this is doubtless owing to their property of quick feeding. He must, however, take it for granted, that the South Devons, which, from known facts, as well as from appearance, have been so much crossed with Norman and Alderney stock, have considerable milking properties, of which he recommends the trial. Zealous as he has ever been for that which we call blood, both in the stable and in the ox-stall, it is now too late for him to regard the whims and vagaries of his boyish days. He has long since given up the idea of the general use of bred hackneys, and has learned, that the substantial is, at least, an equal requisite with the delicate, in an ox. Nothing surely could be more preposterous in speculation, than the idea of crossing Devon cattle, already sufficiently fine, with the Indian zebu; unless indeed with the view of raising a breed for carrying burdens, or for the saddle, in which case it is probable that the introduction of the bison would be a more effectual step. He has yet seen Devon heifers, apparently having Indian blood, squarer in form, and shorter legged, than the pure Devons, and equally well laden with flesh. Impartiality demands of him this avowal."

Mr. Lawrence adds, that "the best bred North Devons, being a hill-cattle, are much more hardy, and better winterers, than could reasonably be predicated of their appearance."

The Sussex and Herefordshire cattle are varieties of the middle-horned or Devonshire breed of a greater size; the Herefordshire being the largest—Of these cattle, Mr. Culley gives the following description:—Colour, red, fine hair, and very thin skin, neck and head clean, horns neither long nor short, rather turning up at the points; in general well made in the hind-quarters, wide across the hips, rump, and sirloin, but narrow on the chine; tolerably straight along the back, ribs or sides lying too flat, thin in the thigh, and bone not large. An ox, six years old, when fat, will weigh from sixty to one hundred stone, of 14*lbs.* to the stone, the fore-quarters being generally the heaviest. The oxen are mostly worked from three to six years old, sometimes seven, when they are turned off for feeding. The author of the Present State of Husbandry in Great Britain, remarks, that when all the properties which should attach to an useful breed of cattle are considered, the middle-horned may be said, as a general variety, to come nearer to perfection than any other in England. They are of a large size, well formed, and in disposition to fatten, they are probably, he thinks, much on a par with the short-horned, and greatly superior to the Suffolk. As dairy-cattle, they are also as valuable as any that fall under the description of quick feeders; for although they give a less quantity of milk than the Suffolk or the long-horned, it is said to be of a richer quality.

Mr. Lawrence however thinks, that "the Herefordshire cattle are obviously at this day a mixed breed, but are, in general, supposed to have been originally of the Devonshire species. There are no documents existing, with which he is acquainted, respecting this presumed origin, or the succeeding crosses, or what length of time the present famous variety has been permanent; but its great size is doubtless derived from an intercopulation with the heaviest of the Welsh breeds, or with that of Shropshire, an adjoining county. A Welsh, chiefly a Pembroke cross, is, he says, now said to be much affected by the Herefordshire breeders. Are we, he asks, to conjecture, that the Herefords owe their bald face to the smoky white faces of the red cattle of Montgomery, from which race, crossed with Devon bulls, originated the celebrated one of which we now speak, their various colours arising from other Welsh crosses: or that the Montgomerys derive their smoky face, and substance, from an Hereford cross?"

The following popular description of this variety, by Mr. Marshall, must, he thinks, "be received with considerable reserve; however, there are certain peculiar prominent features of distinction invariably to be observed among them—the horns, the white face, a faintness or dullness in the colours, great substance, as well as depth of carcase, with (generally) a roundness of the bones. The countenance pleasant, cheerful, open; the forehead broad; eye full and lively; horns bright, taper, and spreading; head small; chap lean; neck long and tapering; chest deep; bosom broad, and projecting forward; shoulder-bone thin, flat, no way protuberant in bone, but full and mellow in flesh; chest full; loin broad; hips standing wide, and level with the spine; quarters long and wide at the neck; rump even with the general level of the back, not drooping, nor standing high and sharp above the quarters; tail slender, and neatly haired; barrel round and roomy, the carcase throughout, deep and well spread; ribs broad, standing close and flat on the outer-surface, forming a smooth even barrel, the hindmost large and of full length; round bone small, snug, not prominent; thigh clean, and regularly tapering; legs upright, and short; bone below the knee and hough, small; feet of middle size; cod and twist round and full; flank large; flesh every where mellow, soft, yielding pleasantly to the touch, especially on the chine, the shoulder, and the ribs; hide mellow, supple, of a middle thickness, and loose on the nache and huckle; coat neatly haired, bright and silky, colour a middle red, with a bald face, characteristic of the true Herefordshire breed."

Of late years, considerable coarseness of bone has, Mr. Lawrence says, been observed "even in the best Hereford cattle: that circumstance is however of trifling, if of any, consequence, and they have proved themselves of such superior excellence, that no pos-

sible cross could be advantageous. The Herefordshire breeders would do well, he thinks, to reflect on the importance of preserving the old blood in a state of as great purity as possible, and to be ever mindful of Mr. Marshall's description. They possess, for some purposes, the most valuable breed of cattle in the world; they have been very judicious, or very fortunate, in nicely blending the elements of such a variety, but they ought not to forget, that, by further mingling and crossing with inferior stock (and where will they find other?), they may, by degrees, recede from the great eminence they have attained. Should, however, a cross become really necessary, from too much coarseness or over-size, Devon or Norman bulls are undoubtedly the proper ones." He conceives, that "the distinguishing qualities of Hereford oxen are, the produce of beef, quick-feeding in proportion to their growth and size, and the union of strength and speed in labour. With respect to the most profitable return in quantity of beef, it may be presumed, no breed in England can stand in competition with this, and they have accordingly been most successful at the annual prize shews. They also command the first price alive or dead."

It has been stated, that "the weight of Mr. Westcar's ox, which carried the prize at the Smithfield cattle shew, in December 1802, stood in this way:

		Stones of 8lbs.	*lbs.*
Head, tongue, skirts, heart, and lights		13	2
Tripe, guts, feet, and liver	-	19	1
Hide	-	10	9
Blood	-	6	0
Fat	-	37	5
	Offals	92	5
Fore-quarter	-	72	1
Hinder ditto	-	65	2
	One side	137	3
	Ditto	137	3
	Carcase	274	6
	Offals	92	5
	Gross weight	367	3

Mr. Lawrence says, that "the northern short-horns, generally called the *Teeswater* breed, are still of larger size than those of Herefordshire; but slower feeders, and it is said more expensive in keep. The Herefords are very conveniently various, as to size, but all require good keep. They are our most powerful draught-oxen, yet speedy enough for any work, either at plough or cart, and will generally walk, he thinks, full as quick as their attendants find agreeable; and, as their meek and placid countenances indicate, they are docile and tractable, and, if trained with temper and kindness, will, he says, drive to an inch with reins. They are equally excellent upon the road, or at plough. But as milkers they have nothing particular to boast of."

It is also supposed, that "the old Gloucestershire *reds* and *browns* were middle-horned, shewing blood, and resembling, in a considerable degree, the South Devons, thick, but of a more square and substantial form. They were a mixed breed, shewed much Welsh blood, and were it may be presumed, more apt to fatten than milk, since they have given way to the long-horned species in that dairy country. It would be difficult, he conceives, at this time, to find any genuine specimens of this old variety."

In respect to the Sussex variety of this breed of cattle, "they are in very high estimation, he adds, for beef and labour, and, in some degree, for milk; in which latter respect they are superior to the Devonshires and Herefords. Like the Herefords, they are, he says, a mixed breed, and much Welsh crossing is sufficiently obvious; but such great pains do not seem to have been taken in their improvement as with the Herefordshires. They are very flat and deep, generally red or brown in colour, and shew much blood; both wide and middle-horned, the points turned upward and backwards, of various size, but the largest generally far too coarse in the bone, and of insufficient width or substance for their great depth of carcase. They yet, he supposes, need no alien cross, having all the materials of improvement within themselves, unless, indeed, to remedy the excessive flatness in some, a Hereford cross might be useful. Their speed appears to him remarkably great, and he doubts whether even the Devonshires are, in that respect, superior; they are equal in powers to the cultivation of the heaviest clays, and to draught over the deepest roads; in temper somewhat quick, like the Devonshire sort. These three noble sorts of cattle, probably not to be matched on the face of the earth for their peculiar excellencies, deserve, he thinks, the utmost care from our national improvers; and it is one of the first objects of national interest to spread them through the country as beasts of labour."

It is supposed by the same writer, that the Kentish *homebreds*, which are produced from dairy-heifers, of a mixed breed, the Sussex generally forming the base, crossed with Welsh, long-horns, Alderney, &c. belong to this breed. "A variety is thus raised, he says, of excellent butter-cows of a small size; and it is suggested to the breeders of this district, whether it may not be worth while to establish and render the breed permanent."

A good specimen of a bull of this sort raised from Sussex bulls, which was introduced into that county about forty years ago, is asserted to have been "remarkable for shortness of the leg, length of carcase, and vast substance; but the bone somewhat coarse, and crooked in the hams."

It is added, that of "the *white* cattle of Surry, mentioned by old writers, he knows nothing, nor does he believe that Surry was ever a breeding county. The notion may have arisen, he supposes, from some temporary introduction of Alderney, or other stock of light colour. In fact, it is said, that some gentleman, about fifty years since, brought up from Lincolnshire, into Surry, a lot of white cows, very large milkers, and that the same kind were at that time kept in Suffolk: they were probably of Dutch extraction."

The *short-horned* breed of cattle, Mr. Culley says, differ from the other breeds in the shortness of their horns, in being wider and thicker in their form or mould, consequently feed to the most weight, in affording by much the greatest quantity of tallow when fattened, in having very thin hides, and much less hair upon them than any other breed except the Alderney; but the most essential difference, he thinks, consists in the quantity of milk they give beyond any other breed; there being instances of cows of this breed giving thirty-six quarts of milk per day, and of forty-eight firkins of butter being made from a dairy of twelve cows; but the more general quantity is three firkins per cow in a season, and twenty-four quarts of milk per day. The great quantity of milk, thinness of their hides, and little hair, are probably the reasons why they are tenderer than all the other kinds, except the Alderney. It is said of this kind, and he supposes very justly, that they eat more food than any of the other breeds; nor can we, says he, wonder at this, when we consider that they excel in those three valuable particulars, viz. in affording the greatest quantity of beef, tallow, and milk.—Their colours are much varied; but the generality of them are red and white mixed, or what the breeders call *flecked*; and, when properly mixed, is a very pleasing and agreeable colour. They are chiefly to be found in Lincolnshire, and the eastern parts of the counties of York, Durham, Northumberland, and Berwick. And this breed, in consequence of its having been originally imported from Holland, is frequently called the Dutch, and sometimes the Holderness breed, from a place of that name in Yorkshire, where it would seem it was first established in this kingdom. Destitute of the exertion and agility of the middle-horned sort, says Mr. Donaldson, they are not so well adapted for the cart or the plough. And, considering their size, and the quantity of food they devour, it is probable, he thinks, that they are inferior to any of the above mentioned; and, when compared with the Suffolk duns, greatly so. Much attention was formerly bestowed by the graziers in the midland districts on the improvement of the long-horned breed of cattle; and probably a greater number of eminent breeders have lately embarked in the laudable undertaking of improving the short-horned breed; and from their knowledge, assiduity, and exertions, much may be expected. Mr. Charles Collings, at Kettens, near Darlington, is supposed at present in possession of the best breed of short-horned cattle in England.

There are many reasons, says the author of the Treatise on Live-Stock, for thinking this breed has been imported from the continent.—First, because they are still in many places called the Dutch breed. Secondly, because we find very few of these cattle any where in this island, except along the eastern coast, facing those parts of the continent where the same kind of cattle are still bred, and reaching from the southern extremity of Lincolnshire to the borders of Scotland. The long-horns and these have met upon the mountains which separate Yorkshire from Lancashire, &c. and, by crossing, have produced a mixed breed, called half long-horns; a very heavy, strong, and not unuseful kind of cattle; but we do not find that the one kind has spread further west, nor the other further east. This breed, says he, like most others, is better and worse in different districts; not so much from the good or bad quality of the land, as from a want of attention in the breeders.

It has been observed, "that the northern short-horned species is the largest breed in Britain, the Herefords standing in the second place in that respect. They are an original species, but whether those of the northern counties are so or not, cannot now be ascertained; that is to say, whether they are aboriginal, or were imported in very early times, as we know they have continually been during several centuries."

In opposition to the long-horns, this breed has, Mr. Lawrence says, "great depth of carcase; but with ample substance, large bone, thin hide, and gives much milk, which is not distinguished for its richness. They are not of first rate character as labouring cattle, as has been stated above, which nevertheless the Holderness variety seems to promise by their form. He looks, he says, to the coarse, square, Dutch beefy breed, as the basis of this species. In many parts of the north they remain still coarse, and by no means equally disposed to large milking. The common Lincolnshire cattle are coarse in head and horn, large boned, high upon the leg, and, to borrow a jockey-phrase, 'ragged hipped.' Equally coarse internally, but producing flesh in great quantity. The Lincoln neat-cattle, in fact, plainly demand, he supposes, a Bakewellian improvement, such as their sheep have received."

It is added, that "the most accurately marked and distinguishable permanent varieties of the northern short-horns, appear to him to be the Holderness and Lincolnshire. Culley, says he, tells us, that amongst the old stock there were some with black flesh, which would grow, but never fatten, provincially called *lyery*: these were to be known by the rotundity of their shape, approaching, in many respects, that of an ill-formed cart-horse. And the extreme coarseness and size of the northern short-horns led, he thinks, to the introduction of Norman or Alderney bulls, at some period of the eighteenth century, with the precise date of which we are unacquainted. Never was a more fortunate cross, as in no other country exists so excellent a breed of cattle, including all the useful properties. In one, perhaps the most important respect, great milking, they are, says he, superior, and even without rivals. Their beef is finer than that of the old short-horned breed, and they fatten much earlier and quicker, carrying still a vast depth of natural flesh, and tallowing within, in the first degree. They have both speed and strength enough, he supposes, for labour, and their shoulders are well formed, and well posited for draught. Being beautifully variegated in colour, spotted, striped, sometimes sheeted red and white, or black or brown and white, they make fine park stock. From their superior quantity of milk, they rival the best long-

horns in the cheese and butter dairies; and, for suckling, are unrivalled. It may be presumed, they are at least equal to the Herefords, in the stall, at all points; and there seems but one respect, in which they are, in any considerable degree, inferior to any breed which can be named, which is fineness of flesh; in that particular it is obvious, they can never equal certain other breeds, without the entire overthrow of their Dutch basis, by a repetition of the Norman, or some similar cross, which would go to destroy the present superior breed. An occasional mixture, however, of Norman blood may, he says, keep the Holderness stock sufficiently fine, and prevent its degeneration on the other side; or a selection might be made of very elegantly shaped and fine boned Holderness cows, with the view of improvement. These are well known, as the stock generally kept by the London cow-keepers. They have small short horns, in the shape of a half ring, rather a long plain head, fine skin, the legs seldom too long, the carcase large, but compact, good back and loin, the general figure square. They are not the species of stock for short keep, however small their size; indeed they are said to be great consumers." But "this high character of the Holderness cattle, he desires, should be received with considerable reserve. It relates to the cows chiefly, and to a selection of the oxen; to what they ought and might be, rather than what they generally are. They are too often, he thinks, the worst shaped cattle in England, and perhaps the least profitable. Long, gaunt, deep carcases, without adequate substance, placed upon high stilts of the coarsest timber. Slow feeders, never fat, and the flesh excessively coarse. The feeding such ill-shaped stock must, he supposes, be immensely disadvantageous, and is particularly disgraceful, in districts which produce the best models." The first object is, in his opinion, to shorten the legs, which surely might, he thinks, be effected "by a conjunction of the best Teeswater and Holderness bulls, with selected short-legged cows. It is a striking fact, obviously, he suspects, indicative of a rapidly increasing population, that notwithstanding unprecedented prices, encouragement and improvements, store cattle are at this instant (1803) so scarce, that many graziers must come short of their needful quantity."

The following statement has been given by the able author of the Treatise on Live-stock, as the weight of a five years old beast of the Teeswater sort killed in 1789, allowing 14*lbs.* to the stone:

	Stone.	*lbs.*	*s.*	*£.*	*s.*	*d.*
Two fore-quarters	74	8½	at 4 per stone	14	18	5
—— hind ditto	75	10	5 -	18	18	7
Weight of carcase	150	4½		£.33	17	0
———— tallow	10	0	at 4 -	3	4	0
———— hide	10	11	4 -	2	3	0
Total	177	1½	Value	£.39	4	0

Mr. Lawrence says, "that the best and quickest feeders of this breed are not remarkable for milking. The Tweed side short-horns are a valuable variety of the Teeswater kind."

The same writer believes, that "the northern *half long-horns* are the immediate produce of a conjunction of the long and short-horns, which must, of necessity, frequently happen upon, and in the vicinity of those mountains, which separate the native district of the two kinds. The horns of this variety, he thinks, generally run out pretty straight and even, unlike those which are called middle, or wide horns. They are a large and long breed of cattle, partaking equally, as may be supposed, of the qualities of each species, and thence ought to be good dairy-cattle, as uniting quality and quantity of milk, and size; in fact, he has been assured by an intelligent Essex dairy-man, that they have the best title to such character, and many years since, when cow-stock was at a low rate, he preferred going to the price of sixteen or seventeen guineas a piece, for this description. They are not so permanently established and generally known as their originals." And "the northern or Yorkshire *polled* cattle have, according to him, the same qualities as the short-horned, carrying vast substance, and some he has seen lately are of great size, although, in that particular, they are most conveniently various. In his opinion, they are a most excellent breed, and well merit improvement, with the view of labour, by a selection of the finest boned and most active individuals. From the shape of these polled cattle, they hold a strict affinity in all respects with the short-horned, amongst which they are found; and it seems that various breeds of horned cattle are attended with hornless, but perfectly congenial varieties."

The *Welsh* breed of cattle, especially such as are found in Cardiganshire, are, Mr. Donaldson says, mostly black, with thick horns turned upwards; of a small size, clean boned, of a good shape, especially where the native breed has not been injured by injudicious crossing with others from England. They are hardy and active; and in great request in the southern counties of England, on account of their being quick feeders. The quantity of milk which the cows of this breed afford is trifling; but they are, upon the whole, a breed well adapted to that country, although still capable of very great improvement; which might be effected with more certainty, and to a greater extent, he thinks, by selecting the best individuals of the native breed, than by bringing others possessing probably very different qualities from England.

It is supposed by Mr. Lawrence, that "there may have been originally two distinct breeds in Wales, the mountaineers having large wide horns, thick hides, and much bone, considering the smallness of their size; the cows producing little milk;" and "the southern and low-land stock, which are of larger size, and finer form, with middle horns, some good milkers; those of Glamorganshire of high repute for draught, on light or hilly lands. They bear some resemblance to the cattle of Normandy. The Welsh cattle are generally deep and flat in form, some of them cloddy, and of great substance also. The Glamor-

gan, Pembroke, and Montgomeryshire, it is to be presumed, he thinks, are the most valuable breeds of Wales. Yet the chief defect in the Welsh cattle, at present, is, he supposes, want of substance, and too great length of leg; to be remedied probably by a Hereford cross, where the object is beef or labour: but, it seems, much English crossing has been used at different periods, without effecting any very material change, the peculiar character of the country being sufficiently apparent in all Welsh stock."

In respect to the different breeds of this breeding province, they are the Glamorganshire sort, which are, according to the above writer, "rather small, of light bone, in colour black or brown, handsome, and shew much blood. They milk well, and feed quick. And his majesty has honoured this breed with his royal approbation, as beasts of labour: they need no improvement from alien crosses; but there are inferior varieties of them, from being mixed with the stock of the borders. This breed, he supposes, prevails in Monmouthshire, and is to be found at the fairs and markets of Pontypool." The Pembrokeshire cattle, which are "coal-black, sometimes dark brown, finched, or with white towards the tail, some have white faces. They were originally finer than at present, probably the same race as the Glamorgans, which some of the Pembroke cows resemble at this time: but the breed has been crossed with the old Leicester, with the view of obtaining milk, in which the improvers did not succeed so well, as in rendering their stock coarse, bony, and unfit for labour. If butter was the object, they had better, probably, he thinks, have retained the imported long-horns unmixed. This cross accounts, he supposes, for the Pembrokes being finched, and having long and round carcasses. They generally labour on the roads, yoked with horses, and their journeys are performed with a speed unknown elsewhere. The Pembroke ox is too leggy, but he becomes early ripe, and will make fat at four years old. He attains the weight of 80 to 130 or 40 stone, London weight, and is said to stand his drift or journey better than any from Wales, whence he finds a preference, particularly in the counties adjoining the metropolis. Two year old Pembroke bulls are bought up at the fairs, at considerable prices, by the improvers of the neighbour counties." The Caermarthenshire original breed is, he says, "black, coarse, ill-formed, short and thick, having wide horns of great substance at the base. The cattle, in course, small in the mountain districts, and of larger size in the vales, in good keep. The improvers there, he adds, have tried various crosses—Hereford, Shropshire, Leicester, Pembroke, Glamorgan, but they say without the desired success. The produce of a Pembroke heifer and Hereford bull, the favourite stock in this county, where, in truth, the prior object ought to be an improvement of keep." The Brecknockshire, which, in the "native breed, is much the same as the above, and those of Pembroke, but crossed with Hereford, and some with Devonshire bulls, labour seems to be the object, and with such crosses, and attention to good keep, a very excellent breed may, he imagines, be raised." The Cardiganshire, which are a "smaller variety of the Pembroke and Carmarthen, hardy, and less milky than most breeds." The Radnorshire sort, which are "dark red, and brindled, in consequence, he supposes, of the original black stock being crossed with the bulls of Hereford and Shropshire, which are adjoining counties. Although these crosses produce stock too large for the hills, they make excellent cattle in good keep, and of considerable size, as from 100 to 120 stone, London weight." But it is said, he says, "that the produce of the Hereford cross has not the characteristic bald-face." The Montgomeryshire sort, which are, in the favourite colour, "blood red, with a smoky face." The oxen from this country fetch high prices at Smithfield.

The Merionethshire, which are, in the "native sort, a small and ill-shaped breed, said to be worst in Wales; but Mr. Corbet, the greatest general improver in the county, has, he says, crossed both the sheep and cattle with good English stock, to much advantage."

The Caernarvonshire sort have, in the "hardy native kind, been formerly crossed and improved, he says, by English bulls and cows, some of them New Leicester and Warwickshire kinds. The improvement succeeded, and, with a small additional expense in rearing, the stock has been found sufficiently hardy, whether in the mountains or plains; and the improved cattle, at two and three years old, are worth more by two or three pounds each than the original breed." The Denbighshire and Flintshire sorts, have been "much crossed and mixed with those of England. Some good milch cows are found in these sorts; which give six or seven gallons per day, three or four months after calving." The Anglesey sort, which are, he says, a small black breed, with wide and thick horns, which are prevalent there, and in far greater purity than in most other parts of Wales. "This hardy race is, he adds, preferred on account of the constant winter exposure, and defect of winter provision, and also because they are approved by the purchasers." An English cross has been attempted without success; which was, he thinks, a necessary result, unless the keep were at the same time improved. "The annual export of cattle from this small island was, he says, some years since, estimated at ten thousand, from one to four year old, which swim over Bangor-ferry. The remaining stock laid at forty thousand. Two drovers alone, bought, in one year, 4786 head. The breeders decline, he adds, keeping any cattle beyond the age of three years, not finding themselves reimbursed the charge of another year. The weight, when fat, at three or four years old, from sixty to one hundred and twenty stone, the fore-quarters being the heaviest. No cross could possibly, he supposes, improve these islanders, unless bulls could be found of superior form, and equally hardy: such are, perhaps, he says, to be sought for in the Isle of Sky."

The same writer thinks, that "in the quality of the Welsh cattle, generally, it may be said, there is no appearance of improvement of late years, notwithstanding the encouragement held out by prices,

of which no former age can furnish a precedent. Indubitably, says he, the want of winter keep, and a good winter system, is the chief cause of this defect."

In the opinion of the above author, the Shropshire *wide-horns* are of this sort, which are "large, square, deep, and bony, with thick hides, in colour brindled, red and brown, the horns branching, points turned upward and backward, being used for labour; and said to be better milkers than their neighbours of Herefordshire, with which they are, doubtless, often blended. Of the origin of this variety no accounts are, he says, extant, or how long they have been a permanent or established breed. It has probably originated in a mixture of the old long-horns, the Welsh, and the red breed of the western districts of the island."

The *polled* or *Galloway* breed of cattle, Mr. Culley says, are a very valuable breed, and seem to be, in weight and size, as much less than the long-horns as these are than the short-horns; they generally weigh from 40 to 60 stone, some particular ones reach 70 and upwards; but their most essential difference from every other breed of cattle is, their having no horns at all; some few indeed, in every other respect polls, have two little knobs or unmeaning horns, from two to four inches long, hanging down loose from the same parts that other cattle's horns grow, and are joined to the head by a little loose skin and flesh. In most other respects, except in that of wanting horns, these cattle resemble the long-horns, both in colour and shape, only they are shorter in their form, which probably makes them weigh less. Their hides seem to be in a medium between the two last-mentioned breeds, not so thick as the long-horns, nor so thin as the short-horns; but, like the best feeding kind of long-horns, they lay their fat upon the most valuable parts, and their beef is well marbled, or mixed with fat.

We find a few of this breed straggling through different parts of England; amongst the rest, remembers the earl of Darlington having had a very handsome variety of them, finely globed with red and white. But we must, he says, look for the original of these in Galloway, a large district in the south-west of Scotland, where they are mostly bred upon the moors or hilly country, and grazed upon the lands nearer the sea, until rising four or five years old, when the graziers and drovers take them up in great numbers to the fairs in Norfolk and Suffolk, previous to the turnip-feeding season, from whence the greatest part are again removed in the winter and spring, when fat, to supply the amazing consumption of the capital, where they are readily sold at high prices; few or no cattle selling so high in Smithfield-market, from their being such nice cutters-up, owing to their laying the fat upon the most valuable parts; a great excellence in all feeding cattle. It is no uncommon thing, in this refined market, says he, to see one of these little bullocks outsell a coarse Lincolnshire ox, though the latter be heavier by several stones.

He has been informed, from good authority, that the polled cows are very good milkers, in proportion to their size, and the milk of a rich quality, yielding much more butter from a given quantity of milk than the short-horns; and also, that the oxen and spayed heifers answer well for the draught; which certainly adds to the value of this excellent breed.

But though the generality of the cattle of the above district are polled, they have several with horns, which, they say, are a bastard or mongrel breed, by crossing with long-horned bulls from Westmoreland and Cumberland.—They prefer the polled ones, and of these the black or dark-brindled ones, to any other; and all allow them to be the original breed of the country. The breeders in Galloway complain of their old breed being lost, or at least much worn out; probably by want of proper attention in the breeders.

According to Mr. Lawrence, this sort, though found in many parts, "exist perhaps no where in original purity, except in the moors of Monigaff and Glenlove, and these cattle are generally thinner in the hinder-quarters, than such as have been crossed by other breeds. They prevail also in Dumfrieshire, particularly on the Nithsdale side." It is remarked, that "although this breed is the most celebrated and favoured in Scotland, where every breeder will boast his true Galloways, yet these have been perpetually crossed, as it should seem, to render them still more true. The original colour black, a few brindled, all perfectly hornless. Amongst the common run of Galloway cattle, we sometimes find them, he says, white faced, and pyed, with small grizly horns, undoubtedly from a mixture with Dutch or English short-horned bulls; but this cross is said to detract twenty per cent. from the worth of a beast. As to form, they are broad and square in the shoulders, long and round bodied, yet deep, straight and broad on the back, with a thick, shaggy coat, the legs of middling length, with large feet. The *pelvis*, or hinder part beneath the tail, and between the two bones, is frequently too narrow, in Galloway cows, whence they want assistance, and sometimes fail in calving. Their character is good as milkers, chiefly for quality. The oxen and spayed heifers make middle-sized beef, of an excellent quality, and the breed is with justice esteemed one of the best in Britain. The Galloway cattle are sold at two years and a half old, and, probably, the English graziers take off annually near thirty thousand head."

The *Suffolk duns*, so called from their being the prevailing kind of neat-cattle in the county of Suffolk, and which some may think a distinct species, Mr. Culley is inclined to believe no more than a variety of the Galloway breed; which might easily take place, from the great connection that has long subsisted between the Scotch Galloway drovers of cattle, and the Suffolk and Norfolk feeders or graziers of them. Both kinds are in general polled; and though the Suffolks are almost all light duns, while the others are of various colours, yet this might at first proceed from a partiality to that colour. But from whatever place or cause this variety took its rise, they are at present a very useful kind of little cattle, particularly for the dairy; and great

numbers of them are employed in that line in some parts of Suffolk, where, perhaps, the best butter and the worst cheese in the kingdom are made. The cows give great quantities of milk. Mr. Young says, they give in common twenty-four quarts a day, which is nearly equal to the best short-horned cows. We find the cows of this kind, like all other deep milkers, very lean, very plain in their forms, and very big-bellied. The weight of this breed of cattle is about 50 stone, on an average.

Mr. Lawrence also supposes, that "this variety, most probably, originated in the polled Galloway breed of Scotland, with which Suffolk and Norfolk have been supplied during more than a century past. They are," according to him, "of lighter colours, smaller, and finer in bone than the Scots Galloways. Long, with a large carcase, clean throat, snake-headed, that is, the neck tapering to the head, thin tail, and rather short legs. These are," he thinks, "very excellent dairy stock, giving the largest quantity of milk, in proportion to their size, of any breed whatever, but not rich in proportion to the long-horns or Alderneys. This breed also feeds well, and the beef is fine: it is one of those breeds of such inherent excellence," he thinks, "as not to be improvable by any known cross. The Suffolk cow is one of the most advantageous for a private family."

The *Scotch* breed of cattle are, Mr. Culley remarks, still less in proportion to the polled cattle than they are to the long-horns; this breed are also covered with a long close coat of hair, like the polls and long-horns; and, like these, their beef is fine grained, well-flavoured, and mixed or marbled, but not so handsome on the outside of the beef when killed, being not of so bright a colour, and often spotted with black, even upon the best parts, except when made very fat. When grazed, they feed very readily; their weight in general being from twenty to thirty-five stone; some particular ones reach to more than forty stone. The most prevalent colour is black; some are brindled or dun: but the breeders here, like those in Galloway, prefer the black ones. These hardy animals are in possession of all that extensive and mountainous country called the Highlands of Scotland, together with the Western Isles, bounded on all sides by the sea and the Grampian Hills; the latter of which begin on the north side of the Frith of Clyde, and run eastward into the sea near Aberdeen. This sort of cattle are frequently termed *kyloes*, in these parts of the country; probably from a district in Ayrshire called Kyle, where they prevail much.

But all the Lowlands of Scotland, except Galloway, have a mixed breed of cattle: towards Cumberland they are half long-horns, half polls; on the borders of Northumberland they are mixed with short-horns, until you reach Tiviotdale, where they become altogether a coarse kind of short-horned, or what the Yorkshire jobbers call *runts*, except a few pretty good short-horned cattle, bred in that pleasant and fine country, the Tweedside. This same kind of runtish coarse breed continues all the way to the Frith of Forth.—Crossing this narrow sea into Fifeshire, you would, he says, at first imagine the Fife cattle a distinct breed, from their upright white horns, being exceedingly light lyered, and thin-thighed; but Mr. Culley is pretty clear it is only from their being more nearly allied to the kyloe, or Scotch breed, and consequently having less of the coarse kind of short-horns in them.

The cattle all along this coast continue, he says, to change more and more, growing still less, until, upon the edges of the mountains, they become quite of the kyloe kind; but still much inferior to that pure, unmixed, valuable breed of kyloes which we meet with in the more northern and western Highlands, and all the isles; but particularly in the Isle of Sky, and that tract of country called Kintail. It is in these two districts that you meet with the native breed of kyloes; a hardy, industrious, and excellent breed of cattle, calculated in every respect to thrive in a cold, exposed, mountainous country, and better adapted to the cold regions where they are bred than any other kind we are acquainted with. These cattle are driven to the southward in great numbers every autumn; many into the western districts of Yorkshire; but the greatest part are sent into Norfolk, Suffolk, Essex, and other parts of the south of England, where they are fattened, and either slaughtered at their home-markets, or sent to Smithfield.

Mr. Lawrence thinks "it not improbable, that there were only two original species of neat-cattle in Scotland, those common to the islands and the mountain country, called kyloes, in colour black, brindled, dun, brown, red; black being the favourite; in form, flat and deep, like the short and middle-horned stock; very small and hardy, with small, upright, short, or middle length horns: and the polled breed, chiefly confined, in later times, to the shire of Galloway, and known by that name. The former, the smallest, and most hardy breed, known in this island, and apparently the same with that of the more northern countries, may be seen, at this day, in its original purity, no motive existing for crossing a breed so perfectly adapted to severity of climate, and scarcity of keep. The original polled cattle were of the same colours, but more varied, and considerably larger in size; in shape, somewhat long, and resembling the long-horned species, with hides of considerable thickness: when these cattle are entirely hornless, they may be presumed of the genuine breed. In the lowlands, where the soil is abundant in provision, and where, in consequence, larger sized cattle are supposed most advantageous, much crossing, under the name of improvement, has taken place. Thus the Scots polled cattle have been perpetually crossed with English bulls, both short and long-horned, with Norman, and with their own mountain stock. Whence the varieties of Galloway, Ayrshire, Fifeshire, and of the runts, which we, at this day, find in Scotland. The Duke of Argyle ranks, saye he, first, as the great herd-master of the north, and the West Highland cattle of his Grace give the fashion, and meet a preference at all markets."

Mr. Culley observes, that "Admiral Sir John Lockhart Ross, and some other spirited gentlemen, have tried some crosses, &c. between long-horned bulls and the Isle of Sky cows. Whether this will answer the end or not, time will shew; but whatever the result may be, there is certainly great merit in the attempt."

It has been remarked, that the kyloes, or dwarf bullock sort, are "worth more in beef, by a penny per pound than any other breed upon the island." On which Mr. Lawrence observes, that "this may be frequently true, on the simple account of smallness of size; however, the beef, to evince its superior excellence, need but be seen and tasted. But his experience of this famous breed will not warrant him in carrying the superiority forward to quantity also, since he has been often convinced that the kyloes will not equal our larger breeds in quantity of beef per acre, whence, he says, if kyloe beef must be allowed the best, it must also be acknowledged the most expensive meat."

It is stated, that "the Highland cattle, in their natural, unimproved state, are frequently well formed. Their fine eyes, acute face, and lively countenance, give them an air of briskness, or rather fierceness, heightened by white, tapering, black-tipped, and sharp horns, pointing upwards, forwards, or backwards, which are really dangerous. Their most common weight in Smithfield is from thirty-five to forty-five stone, but they may be made much heavier. The weight of a kyloe, as given by Mr. Culley, is very considerable.

	Stone	lb.
Two fore-quarters - - -	43	12
—— hind ditto - - - -	37	8½
	81	6½
Tallow - - - - - -	13	0
Hide - - - - - - -	6	4
Total	100	10½

or upwards of 176 stone, London weight.

And it is added, that "the Isle of Sky bulls are of the highest repute, and some years since, the improvers of Argyleshire would go to the price of twenty or thirty guineas, for a well-bred bull, the chief characteristics being, fine eyes and horns, and a thick pile. This breed (another exception) although by no means long-horned, nor remarkably thick hided, exceed in the quality, rather than the quantity of milk; and in that view, must be crossed with Norman, or some other milky breed. A Fife cross increases the milk."

It is stated, that "the best Highland cattle, it is said, are bred in Lochabar, Sunart, Morvin, N. Argyleshire, and Cowall, or Rannock, in the central Highlands. They are sound and hardy stock, little liable to diseases of any kind."

And "the Orkney Isles are, he says, said to produce a small, ill-shaped breed of cattle, which are both good milkers and excellent beef. The cattle of Bamf are amongst the largest and best of the north. And the Fifeshire stock are of considerable size; black, lively, up-horned, and of good repute in the south: they feed quick, and are fit for labour. For the dairy, their cows have the character of giving rich milk, rather than any great abundance; their produce in butter about seven pounds per week, and they are steady in the continuance of their milk. Upper Fife cows, and a Highland bull, are, he says, supposed very eligible for a northern dairy: one would, he thinks, judge an Orkney bull preferable, from the reputed milkiness of that breed" of cattle.

"Renfrew and Ayrshire are said to afford the best milch cows, considering their size, which are to be found in Britain; and that both in point of quantity and quality of milk, producing from three and a half, to seven gallons per day. They are usually called Dunlop, and have the character of being the best possible 'poor man's cows,' from their ability to shift on very scanty keep. In appearance, they are, he says, small, and ill-looking, with the shape and pile of Highlanders, yet bearing more resemblance to the Dutch, than to any native Scots breed. Their horns are short and small, standing remarkably irregular and awkward; colour generally pied, or of a sandy red. They appear unthrifty and thin, like the Alderney, even in the best pasture, and the few which are bred up to oxen make but a poor figure in grazing, scarcely reaching the common weight of kyloes. He apprehends this milky race to be the result of crossing the cows of the country with Alderney bulls, the cows, perhaps, having previously a portion of Dutch blood."

It is observed by the same author, "that the Berwickshire cattle have been improved by Teeswater bulls from Northumberland. They will make, he says, at three years old, sixty to nearly four score stones of fourteen pounds, and at five and six, from eighty to one hundred and twenty stones. Their best cows will milk as high as six gallons per day. The Berwickshire ox is, he says, thus described. "Long face, open countenance, clean and small, turned up curving and spreading horns, straight shanks, straight and round along the back, full and deep in the ribs, short legs, thighs turned out, open boned."

The *Alderney* or *French* breed of cattle, Mr. Culley says, is mostly to be met with about the seats of our nobility and gentry, upon account of their giving exceedingly rich milk. He imagines this breed to be too delicate and tender ever to be much attended to by British farmers, because they are not able to bear the cold of this island, particularly the northernmost parts of it. They are very fine-boned in general, light-red, or yellow in colour, and their beef generally yellow or very high-coloured, though very fine in the grain, and well-flavoured. They make themselves very fat; and none of them are in the least subject to lyer, or have black flesh. He has seen some very useful cattle bred from a cross between an Alderney cow and a short-horned bull. See *Alderney Cattle*.

The *Wild* breed of cattle, from being untameable, can, Mr. Culley thinks, only be kept within walls or good fences; consequently very few of them are at present to be met with, except in the parks of gentlemen, who keep them for ornament, and as a curiosity: those at Chillingham-Castle, in Northumberland, a seat belonging to the earl of Tankerville, are, he says, invariably of a creamy-white colour, with black muzzles; the whole of the inside of the ear, and about one-third of the outside, from the tips downward, red; horns white, with black tips, very fine, and bent upwards: some of the bulls have a thin upright mane, about an inch and a half or two inches long. The weight of the oxen of this breed is from 35 to 45 stones, and the cows from 25 to 35 stones, the four quarters, 14lb. to the stone.—The beef is finely marbled, and of excellent flavour. From the nature of their pasture, and the frequent agitation they are put into by the curiosity of strangers, it is scarcely to be expected, that they should get very fat; yet the six-years-old oxen are generally very good beef, from whence it may be fairly supposed that in proper situations they would feed well. When the cows calve, they hide their calves for a week or ten days in some sequestered situation, and go and suckle them two or three times a day. If any person come near the calves, they clap their heads close to the ground, and lie like a hare in form, to hide themselves: this is a proof of their native wildness. The dams will not allow any person to touch their calves, without attacking them with an impetuous and savage ferocity.

From the above general descriptions of the different breeds of cattle, it is evident, that all the sorts taken notice of are not equally profitable to the breeder, the rearer, the dairyman, the grazier, the butcher, or the consumer. Some have a greater disposition to fatten than others. Some, being cleaner boned and better formed, have less offal. Some give a greater quantity of milk than others. In a word, some of the particular properties for which cattle are estimable are more discernible in one breed than in another. Whether, says Mr. Donaldson, these can be all united in the same animal, or whether a breed of cattle, possessing all the requisite qualifications, would be equally suitable to all situations, are questions not easy to be determined. In regard to the first, says he, it seems universally agreed, that there are two properties for which cattle are esteemed valuable, that cannot be united; that is, a disposition to fatten, and a tendency to yield a large quantity of milk. The form of the animal most remarkable for the first, is very different from that of the other; in place of being flat in the sides, and big in the belly, as all great milkers are, it is high-sided and light-bellied: in a word, its body is barrel-formed, while that of the other is more fitted to embrace a horse-collar with the wide side downwards. It is not probable, therefore, that the properties of two breeds of cattle, so opposite in form and general appearance, can ever be united in the same animal. If a large quantity of milk, whatever be its quality, is the object, the dairy-man must content himself with such plain ill-looking animals as have been described above. And as the milk of all cows is well known not to be of the same quality, it appears, he says, highly probable, that in proportion as the cows of the milking tribe exceed those that are more disposed to fatten in quantity, in nearly the same proportion will their milk be inferior in quality. If this should prove to be the case, the superiority of the quick feeders, one would suppose, says he, to be completely established; as, while cattle of this description are confessedly better for the purposes of the graziers, the butchers, and the consumers, they would, if this point were determined in their favour, be also more valuable for the dairy. No person will think of asserting, that a gallon or two of whey, or of butter-milk, extra (for the question, he thinks, comes to that), is a sufficient reason for preferring a breed of plain-looking, ill-formed cattle, to one that, except in this particular, is more valuable in every respect. In a word, no person, who pretends to a knowledge of the different breeds of cattle, will think of supporting an opinion so erroneous, as, that cattle which are disposed to fatten quickly, and at an early age, that, from the superior excellence of their form, have a small proportion of offal, or what the breeders call non-essentials, and that although they yield not a large quantity of milk, yet make up for that deficiency in the richness of its quality,—are no more valuable than those which have nothing to recommend them, but the single property of being great milkers.

In comparing the breeds of long and short-horned cattle, Mr. Culley observes that the long-horns excel in the thickness and firm texture of the hide, in the length and closeness of the hair, in their beef being finer grained and more mixed and marbled than that of the short-horns, in weighing more in proportion to their size, and in giving richer milk; but they are inferior to the short-horns, in giving a less quantity of milk, in weighing less upon the whole, in affording less tallow when killed, in being generally slower feeders, and in being coarser made and more leathery or bullish in the under side of the neck. In few words, says he, the long-horns excel in the hide, hair, and quality of the beef; the short-horns in the quantity of beef, tallow, and milk.—Each breed have long had, and probably may have, their particular advocates; but if he may hazard a conjecture, is it not probable that both kinds may have their particular advantages in different situations? Why not the thick, firm hides, and long close-set hair of the one kind, be a protection and security against those impetuous winds and heavy rains to which the west coast of this island is so subject; while the more regular seasons and mild climate upon the east coast are more suitable to the constitutions of the short-horns?—When he says the long-horns exceed the short-horns in the quality of the beef, he means that preference is only due to the particular variety of long-horns, selected, improved, and recommended by that attentive breeder, Mr. Bakewell; for, as to the long-horned breed in common, he is inclined to think their beef rather inferior, than superior, to

that of the generality of short-horns; and there is little doubt but a breed of short-horned cattle might be selected, equal, if not superior, to even that very kindly-fleshed sort of Mr. Bakewell, provided any able breeder, or body of breeders, would pay as much attention to these as he and his neighbours have done to the long-horns. But it has hitherto been the misfortune of the short-horned breeders to pursue the largest and biggest boned ones for the best, without considering that those are the best that pay the most money for a given quantity of food. However, the ideas of our short-horned breeders being now more enlarged, and their minds more open to conviction, we may hope in a few years to see great improvements made in that breed of cattle. Such rapid improvement has indeed lately taken place in the breeding of short-horned cattle, that he has reason to think they must soon surpass their rivals, the long-horns.

But he adds that, notwithstanding these two breeds have hitherto been in possession of the best part of the island, he is inclined to think that the Galloway cattle, and even the Scotch or Kyloes, might be bred with advantage in many situations, so as to be more profitable than either the short-horns or the long-horns: he has a very high opinion of both these breeds of cattle, as true quick feeders, and being kindly-fleshed, or excellent eating beef, which character they have established in the first market in the island.

He is likewise of opinion that the Scotch or Kyloes are better adapted to cold, exposed, heathy mountainous situations, than any other breed we have; and that particular breeds are probably best adapted to particular situations; on which grounds he recommends to breeders of cattle to find out which breed is the most profitable and best suited to their situations, and to endeavour to improve that breed to the utmost, rather than try to unite the particular qualities of two or more distinct breeds by crossing, which is a precarious practice; for, says he, we generally find the produce inherit the coarseness of both breeds, and rarely attain the good properties which the pure distinct breeds individually possess.

It must be plain, from what has been already advanced, that, in order to have good cattle of any breed, particular regard must be paid in selecting those that are the most complete and perfect in their form, shape, and other qualities, and to breed from them. See *Breeding Bull* and *Cow*.

It is observed by the author of the Rural Economy of Yorkshire, that the horn is a good criterion for distinguishing the different species, if the term be applicable, of cattle. It is a permanent specific character. The colour, though not altogether accidental, is changeable; and neither the form nor the flesh is permanently characteristic of any particular species. Good form and good-flesh may be found in every species; though they are by no means equally prevalent, nor equally excellent, in all. But a horn six inches long was never yet produced by the Craven breed; nor one a yard long by the Holderness breed. And the middle-horned breed of Herefordshire, Sussex, and other parts of the island, appears to be as distinct a species as either of the former. He is not, however, a bigot to horns of any shape or length; as he would as soon judge of a man's heart by the length of his fingers, as of the value of a bullock by the length of his horns. If his flesh be good and well laid on, and his offal be proportionably small; if he thrive well, fatten kindly at an early age, or work to a late one if required; he would much rather have him entirely without horns, than with any which enthusiasm can point out. But the horn as a permanent specific character of cattle may, in varieties, have its use as a criterion. Thus, says he, supposing a male and female of superior form and flesh, and with horns resembling each other as nearly as the horns of males and females of the same variety naturally do, no matter whether short or long, sharp or clubbed, rising or falling,—and supposing a variety to be established from this parentage,—it is highly probable that the horns of the parents would continue for a while to be characteristic of the true breed, and might, by inferior judges, be depended upon, in some degree, as a criterion. But still, says he, it is indisputable that horns remain the same, while the flesh and fattening quality change; but every man of superior judgment will depend more upon the form and handle of the carcase, than upon the length and turn of the horn. For it is a notorious fact, that the individuals of a given variety may have exactly the same horns, without having exactly either the same fashion or the same flesh.

If, however, there be any criterion or point of a beast which may be universally depended upon as a guide to the grazier, it is, he thinks, the EYE, not the horn. The eye is a mirror in which the health and habit of the animal at least may be seen with a degree of certainty.

In the rearing of cattle, different methods are pursued in different districts; but it is obvious that the better they are fed at an early period, the better stock they will in general make.

The practices that are followed in different places, in respect to the early treatment of calves, have been described more fully under the head Calf. See *Calf-rearing*.

In the management of young cattle, it is remarked by Mr. Donaldson, that the method of managing them during the first winter, is pretty generally the same in every part of the island. They are almost always housed: sometimes bound up to the stall; but more frequently allowed to remain at freedom. The way of feeding them in England is chiefly with hay, or hay and straw mixed; and in Scotland, sometimes hay, but more frequently straw and turnips.—They are mostly turned out on some of the inferior pastures on the farm the following summer, and maintained the second winter on straw in the straw-yard, or in houses or sheds erected for the purpose. Some farmers in the more northern parts of the kingdom, from being situated at a distance from any market at which they can dispose of stall-fed beef, very frequently give a considerable part of their turnip-crop to their young cattle. This is, he thinks, an excellent prac-

tice; and one that ought to be followed, even by those who, from being better situated in regard to markets, can adopt other methods of using turnips to advantage. The benefit of green winter food for live-stock is so great, that there is probably, he says, no way in which turnips can be used, by which the farm or the farmer would reap greater benefit, than by giving the young cattle a daily allowance during the first two or three winters. There is but very little variation in the management of young cattle from this, during the time they remain in the breeder's possession, which must be longer or shorter, according to the peculiar circumstances of the case, and the nature of the farm.

In some districts, he further observes, it is the usual practice to allow the young heifers to take the bull at two years old; in which case, what are not necessary for keeping up the stock are disposed of the following spring, before they drop their calves. And where the practice of ploughing with oxen is continued, or has been a second time introduced, young oxen are broken into work in the course of the second summer; this, however, is by no means common, as, he says, probably, nine-tenths of the cattle reared in Great Britain remain in the breeder's possession till the spring of the third year. The young cows are then disposed of to the dairy-farmers, who often do not breed a sufficient number to supply themselves; or to the cottagers, who have the means of keeping a cow in summer, but not in winter. And the young oxen sold, either for the purpose of supplying the ox-teams, where these are still kept; or to the graziers, who sometimes fatten them for the butcher in the course of the grass-season, but more frequently content themselves with only putting them in condition to be stall-fed during the following winter. The premature age at which such cattle as are not employed in the operations of husbandry, are now fattened, is, he thinks, a positive evidence of the scarcity of that species of live-stock. Exclusive of the cattle used in the plough or cart, which are permitted to live a year or two longer, the oxen in this country are in general killed before they are four years old—an age at which, it is well known, an ox does not fatten to the greatest advantage. And Mr. Marshall says, that in Norfolk, when the lattermath and stubbles are finished, the yearlings—provincially "buds," are put to turnips; either as followers to the bullocks, or have some fresh turnips thrown to them: in either case, they sleep in the par-yard, and generally have a separate par allotted them; though sometimes they are parred with the two-year-olds. In the yard, the best of the "stover" is allowed them, and, perhaps, a little ordinary hay: it being a maxim, pretty generally adopted among good farmers, to keep their young stock as well as they can the first winter. In spring and summer, they follow the bullocks, and run in the meadows; or, if these be wanting, are sometimes sent out to summer-grass, in the marshes or grazing-grounds. The two-year-olds run in the stubbles and broken grass till Christmas, or until turnips can be spared them; when they generally follow the bullocks. In winter, they are always "parred" at night; sometimes with the cows, sometimes with the buds, sometimes alone. Good farmers generally keep them separate:—if parred with the buds, they rob them; if with the cows, they are liable to be "horned," and are never at rest; except while the cows are eating up the best of the fodder. Some farmers, when turnips run short, "put out" their two-year-olds in winter; and others, when they are plentiful, "graze," that is, fat their two-year-olds. In general, however, they are "kept over-years," on meadows or lays, or are sent to the marshes or grazing-grounds, as situations and circumstances point out; and, at Michaelmas, are put to turnips, as fattening-cattle. The agistment price for two-years-olds, from May-day to Michaelmas, varies with the keep.

On the management of young stock, it is also observed, in the Rural Economy of Yorkshire, that they are invariably housed the first winter; generally loose, and mostly indulged with the best hay the farm will afford. Their summer-pasture is such as conveniency will allow them—frequently of a secondary nature. In the open-field state, the common was generally their summer-pasture. The second winter, oat-straw is the common fodder of young cattle—generally tied by the neck in hovels, or under sheds. Their summer-pasture, commons, woody wastes, rough grounds, or whatever best suits their owner's conveniency. At two years old, the steers, provincially *stots*, are generally broke-in to the yoke; but are not, by good husbandmen, worked much at that age. At two years old, also, the heifers, provincially *whies*, are generally put to the bull. This, however, is not an invariable practice. In the state of commonage, they were frequently kept from the bull until they were three years old: now, in the state of inclosure and improvement, and at the present high rents, they are frequently suffered to take the bull when yearlings, bringing calves at two years old. This, says he, is an interesting subject in the management of cattle. Farmers, in every district, differ in their opinions respecting it. The arguments for bringing heifers in at two years old, are, that they come sooner to profit; and that farmers cannot afford, at the present rate of rent, to let them run, unprofitably, until they be three years old. On the other hand, the argument in favour of bringing them in at three years old is, that, not being stinted in their growth, they make larger, finer cows, than those which are suffered to bear calves at a more early age. But we have not yet met with any man who even attempts to prove which of the two is, upon the whole, the more profitable practice. The gardener, he remarks, seems to be well aware, that suffering a tree to bear fruit too early, checks its growth; and there may be some analogy, in this respect, between vegetables and animals. But even admitting this, if the cow receive no injury as to thriving, calving, milking, nor any other than that of being checked in point of size, the objection appears to fail. If, however, early production check not only the cow, but her

progeny likewise, an objection, no doubt, will lie against it. He has long been of opinion, that it is, in general, the farmer's interest to let his heifers take the bull whenever nature prompts them. There is, undoubtedly, some present profit arising from their coming in at an early age; and whether a middle-sized cow may not afterwards afford as much neat profit as one of larger stature, is certainly an undetermined point. Much, however, depends upon keep. A starveling heifer will not take the bull at a year old. Nor ought any yearling heifer, which has taken the bull, ever afterwards to be stinted in keep. If she be ill-kept while with calf, there will be danger at, or after, the time of her calving. If afterwards pinched, there will be danger of her not taking the bull the next year. Hence, he thinks, we may infer, with a degree of safety, that the propriety, or impropriety, of bringing heifers into milk at two years old, depends principally upon soil and situation. On a good soil, and in a genial climature, in which heifers do not experience a check from the time they are dropt, they ought, he is clearly of opinion, to be permitted to take the bull whenever nature prompts them. But in less genial situations, where lean ill-herbaged lands are to be pastured with young cattle, it appears to him equally evident that heifers ought not, in strictness of management, to be suffered to come into milk before they be three years old.

There cannot be any doubt but that a large stock of cattle in feeding demands considerable and constant attendance, and that of steady and capable hinds; as, without a proper regard be paid in these respects, much confusion must occur, especially when fed in the fold-yard.—Next to proper food, says the author of the Farmer's Calendar, the two great points in feeding animals, to proof, are, regularity, and a particular care of the weaker individuals. On this last account there ought ever to be plenty of trough or rack-room, that too many may not feed together; in which very common case the weaker are not only trampled down by the stronger, but they are worried, and become cowed and spiritless, than which there cannot be a more unfavourable state for thrift; beside, these are ever compelled to shift with the worst part of the meat. This domineering spirit is so remarkably prevalent amongst horned cattle, that he has a hundred times observed the master beasts running from crib to crib, and absolutely neglecting their own provender for the sake of driving the inferior from theirs. This is, much oftener than suspected, the chief reason of that difference so visible in a lot of beasts, after a winter's keep. It is likewise, he says, a very common and very shameful sight, in a dairy of cows, to see several of them gored and wounded in a dozen places, merely from the inattention of the owner, and the neglect of tipping the horns of those that butt. The weaker animals should be drawn and fed apart; and in crib-feeding in the yard, it is a good method to tie up the master-beasts at their meals. Where a sufficient number of cattle are not bred upon the farm, they are generally bought in at the neighbouring fairs to fat at spring, and about Michaelmas. Those bought in at spring will be fat in July, August, or September, according as they are forward, and there is keeping for them; and those which are bought in at August, September, or October, must be either to sell in winter or in spring, and must be forward in flesh to be improved the beginning of winter, and kept up in flesh during the winter, with burnet, hay, turnips, carrots, or other kinds of food, to be fit for a good market whenever it offers; or they must be young lean cattle, that may, by their growth, pay for their wintering, and to be fit to fat the next summer. Some upon ordinary land buy in young Welch heifers, which, if they prove with calf, they sell in spring, with a calf by their side for the dairy; and those that are not with calf they fatten: all which ways frequently turn to good account: but as most commonly all meat, either at Christmas or in the spring, is one-third part dearer than in summer; as all have not the conveniency either of hay, turnips, &c. to fatten cattle with in winter; it is best to have them ready for the markets about these times.

The farmer who intends to graze cattle to the most advantage, should be particularly attentive to these three things: first, to raise a good quantity of artificial grass for hay and aftermaths. Secondly, to turn a good quantity of ground into rich pasture, by feeding it, dunging it, and laying on it other manure, to make it fit for raising the bullock or heifer in the spring, when they come first from hay to grass, and to receive them with a vigorous aftermarth, when other grasses, as clovers and other grass aftermarth, go off. Thirdly, to have hovels or other buildings inclosed with close walls, to shelter the cattle in the winter from wind and rain. By adopting these methods in fattening cattle, the grazier, from having plenty of hay, will be enabled to purchase barren beasts before the spring grass comes, when it is most likely they will be cheap, and may be bought to the best advantage, allowing for the value of the hay they may eat, in consideration with the purchase: and if, by winter-hayning some meadow-ground after it has been kept high in heart by feeding, &c. he can, early in the spring, by April, or sooner, have a bite to take off such grazing beasts from hay to grass, it will be very advantageous before clovers can be ready, which in many places are seldom so till a week or a fortnight in May; and by such meadows for an aftermarth, which towards the end of summer are in very good heart, he may support his bullocks, and carry them on when the strength of other grasses fails. All fattening cattle, whether barren cows or oxen, require a proportionable progression from coarser to better food, as they grow more and more into good flesh; otherwise, when half fat, they will frequently go back, and the grazier will not, without great difficulty, be able to raise them again, which must be a great loss to the proprietor.

In respect to oxen, they are in most places, where they are worked, turned off to fattening at two seasons of the year, which, in several respects, are very convenient. The first is about May-day, when the labour is pretty well over for the spring-season—

the spring-corn being then generally all sown. The second is the beginning of winter, namely, from the first of October to the middle of November, when the wheat and winter-vetches are mostly put into the ground.

With regard to the various kinds of food with which the cattle are generally fattened, they may be reduced under the following heads: grass, turnips, grains, wash from the distilleries, oil-cake, corn, cut-chaff, &c.

The fattening cattle, Mr. Donaldson observes, are usually put to grass in May or June, according to the season and situation in regard to climate. The period necessary for fitting an ox for the butcher depends on several circumstances; as the condition he was in when put to grass, the nature of the pasture, and many others; but, in ordinary cases, an ox will be completely fattened in three months. There is, he says, one method of fattening, connected with the grazing system, that the farmers in England are enabled, from the superior excellence of the climate, to adopt with success, which can never be attempted with propriety in Scotland. It is very common, at the close of the grass-season, when the fattening stock happen not to be fully in condition for the butchers, to render them so, by giving them hay two or three times a day in the field, or in hovels erected for the purpose, into which they have access at pleasure.

When turnips are employed for the purpose of fattening cattle, especially if they are put up to the stalls in proper condition, which, considering the season of the year (November), must, with ordinary attention, always be the case, from ten to thirteen weeks is fully sufficient to render them fit for market.

The fattening of cattle with grains may, in some respects, be considered as a branch of the distillery business; but yet there are some instances wherein those who cultivate farms practise it with a double view—of obtaining a profit on the sale of cattle, and the acquisition of a valuable treasure of useful manure. Mr. Adam, the renter of the farm of Mount Nod, near Streatham, in the county of Surry, has erected a very complete building, for the purpose chiefly of fattening cattle on grains. In this building may sometimes be seen several hundred head of cattle.

The method of fattening cattle with oil-cake, corn, cut chaff, &c. is practised in many of the English counties, with a degree of success sufficient to warrant farmers in other parts of the island to follow the same practice. The cattle are commonly put up to fatten at the end of the grass season. The usual allowance of oil-cake, after it is broken in a large mortar, or, in the fruit districts, in a cyder-mill, is about half a peck per day, which is given, one half in the morning, and the other in the evening; to which is added hay, and in some cases ground corn, that is, oats or barley of inferior quality, and cut straw—provincially "chaff." As bullocks fattened in this manner get regularly five, and sometimes six, meals a day, it is sufficiently evident that, although it may be upon the whole an expensive mode of fattening, yet it must be both expeditious and effectual. See *Stall-feeding*.

Mr. Marshall, in speaking of a Cotswold grazier, observes, that his fattening cattle are all tied up, some in single, some in double stalls. His reason for this practice is not altogether that of saving room; he is clearly of opinion that they do better, fat faster, than bullocks which are kept in loose stalls. His reasoning is fair. Besides the indisputable advantage of their not being liable, in this case, to foul their meat and water; he holds out another which is not so obvious, but may nevertheless perhaps be equally true: cattle which are tied up are more cadish (tamer, less wild) than those which are kept in loose stalls. A loose bullock (some loose bullocks at least), when a stranger enters the shed, or any disturbance happens in it, will rise and fly into the yard for refuge; while a bullock which knows that he has not the power of flight, will lie still and chew his cud. In the yards, loose bullocks are equally liable to disturbance; and quietness is no doubt essential to quick fattening. Each bullock has two troughs—a small one for corn, a large one for hay, with a water-trough, which runs the whole length of the shed, and is covered by a board; each bullock having a hole (large enough to admit the nose) to drink at. The water-trough (a hollow tree) forms, as it were, a top-rail to the partition wall of the gangway. The others are beneath it, nearly level with the bed of the stall. The corn is ground, and given to them, mixed among cut hay, two or three times a day; beginning with about half a peck, and increasing to about a peck a day. The method of feeding with hay, which in this instance is practised, does, he says, the practitioner infinite credit. He feeds his bullocks with hay, as cart-horses are usually fed with corn: giving it to them by handfuls at once: never more at a time than the two hands can grasp; continuing to feed them in this manner until they lie down, or until they refuse to eat. Thus they never have any hay to blow upon (the great objection against tying up bullocks): even at night, they have not a mouthful left before them. The leading principle of this practice is, that fatting cattle should never be cloyed with food; should always eat with an appetite. In the morning they are fed with the worst of hay (if any difference); for, being then hungry, they eat it with an appetite. Thus the hay is eaten up clean, and the bullocks are preserved in a thriving habit; while the extraordinary expense, where a number of cattle are fatted at once, is inconsiderable. In this case, it is proper to appropriate a man's time to their attendance; and he might as well be employed in feeding them by handfuls, he thinks, until they lie down, as in cloying them with armfuls, and idling the rest of his time away.

The author of the Agricultural Report of Lincolnshire observes, that about Huckthorn the larger farmers buy in beasts in autumn, put them to eddish, and then feed with cake; sell from Christmas to May-day: this is done for the sake of the dung; and it is thought if that is cleared, that it answers well. Mr. Thorpe, at Kirton, he says, fattens many beasts

every winter on cake; his landlord, Mr. Harrison, having built him for that purpose very convenient stalls, in a double range, with a gangway between their heads. They are in the Hereford style; the beasts may be loose or tied: a pump supplies water by troughs to cisterns: the whole well executed. He has sold beasts from these to 38*l.* a head, and fats forty in a season. The same farmer has on his farm at Owersby another bullock-house, in the same form nearly; here he fats also on oil-cake; but the dearness of it induced him to substitute lintseed, boiled and mixed with barley-meal; two quarters of barley, four bushels of lintseed; and mixed, to give cold, in the form of a rich jelly; this quantity will go as far as half a ton of cakes, costing less, when barley is not extravagantly high, that is, 24*s.* a quarter:—half a peck of lintseed is boiled in four gallons of water. He inquired of Mr. Thorpe, particularly, if he had reasons adequate to the expense for not tying beasts in their stalls, instead of giving them so much room separately; and he is clear they fatten much better: this *necessity*, however, he says, is not ascertained; for the question can hardly be considered as answered in any case where a farmer builds, and a landlord pays. Mr. Thorpe buys his beast at Lincoln; he thinks the Holdernesse too big for his purpose; but there is a very good cross of long and short-horns about Spilsby, which fatten kindly, and which he likes to buy. Is of opinion, from very considerable experience, and speaking of grazing in general, both summer and winter, that middling-sized beasts will pay better than large ones; for instance, two of 50 stones will answer better than one of 100; they do not take so much food to bring them to their weight, and will do on worse pasture.

At Knaith, where the pasture is not of the first quality, Mr. Dalton has fattened Teeswater beasts to 130 stones, at seven years old, and gave only half a ton of cake to each. He prefers this breed to any other he has tried. His beasts of 80 stones will be fat at five years from grass, without any cake; and his regular return is seven a year, at four years old. The cows are good milkers in their own country, but here are not equal to Lincolns. He is of opinion, in relation to the size of fattening animals, that an ox of 80 or 85 stones will not eat more than one of 50, and his bailiff thinks he will not eat so much. At Bankside, Mr. Webster feeds his cows, and his team-horses, with steamed turnips and cut chaff, with great success. Mr. Ellison, at Sudbrook, buys in about thirty bullocks annually; from April to Midsummer; puts to grass till a fortnight after old Michaelmas; then puts them part in stalls, and part remains in grass till near Christmas. In the stalls, feeds with cake and hay: they eat about two and a half cakes a day, at seven pounds each, and about half a ton of hay each beast; and are up about ten weeks, some twelve. They were bought in at 15*l.* each last year (1798); and sold at about 26*l.* In general, reckons them to pay 10*l.* each, which answers well. Prefers the short-horned breed, has tried long-horned Cravens, but they did not answer at all. His bailiff chooses the smallest boned ones he can get; clean heads and muzzles, wide in the hips, out in the ribs, and deep in the fore-quarter. The greatest fault in the Lincoln short-horns is being thin in the backs and chines; it is not universal, but very common; but, upon the whole, they fatten kindly. Observes, that the oil-cake dung is uncommonly rich, so as by mixing to make the straw-dung excellent. Mr. Moody, of Riseholm, fattens many beasts upon oil-cake, even as far as buying 100 tons of cake in a year. He keeps them loose in a straw-yard, and finds they do well without any hay, giving straw only in addition; and has sold beast thus fed at forty guineas. The duke of Ancaster fattens many beasts; he buys in from Candlemas to Midsummer, generally Scotch and Welch bullocks, of from 34 to 50 stones, sometimes larger; sells fat from Midsummer to December. Gives on an average for the two last springs, 8*l.* 8*s.* or 9*l.* each, and sells at 13*l.* to 17*l.* They are kept through the winter in the park, and go off at Midsummer twelve months after. Have no fodder, except in a blast. North Wales, Pembroke, and Highland Scots, found very little different in advantage; the Welch grow rather more, and come to greater weights. The Fifes grow more than any, when they happen to be bought, but they require foddering.

It is observed by the author of the Rural Economy of Norfolk, that the practice of fattening bullocks on turnips is now beginning to creep into every part of the kingdom: but it may be said to be still in a state of infancy every where, except in Norfolk; therefore an accurate account of the practice of this parent-country cannot fail of being useful to every other turnip-land district. And that, impressed with this idea, he spared no pains, nor let slip any opportunity, of making himself acquainted with the subject. The only species of cattle fatted in East-Norfolk, he says, may be said to be home-breds and Scots. Some Irish beasts have, at different times, but not regularly, been brought into the country, and have generally done very well. In West Norfolk, great numbers of Lincolnshire and Yorkshire oxen were formerly, and some few, he believes, are now, fattened; but, in this district, they have always been considered as much inferior to the Scotch and home-bred stock. Home-breds consist of steers, spayed heifers, open heifers, barren cows, running calves. The last is a species of fattening cattle peculiar, perhaps, to this county. They are calves, which are suffered to run with their dams until they be a twelvemonth or more old: the cow being all the while at head-keep, of which the calf partakes, as well as of the milk of its dam: while herself, in the mean time, generally gets fat enough to be sent to Smithfield, with her calf (perhaps as heavy as herself) by her side. The Scotch cattle fatted in Norfolk, consist of Galloway Scots; other Lowland Scots; Highlanders; Isle of Skys. The Galloway Scot is large, thick, short legged, mostly hornless, and of a black or brindled colour: the flesh well grained; and the form altogether beautiful: chine full; back broad and level; quarter long and full at the

nache; round barrel; deep girt; and the bone, head, and chap, in general, fine. This, he apprehends, is the genuine original Galloway Scot; and a principal part of the bullocks brought into Norfolk under that name are of this description: but the droves are generally adulterated with a mongrel sort, the produce of a cross with the long-horned breed. This species of adultery, he remarks, is said to be committed and encouraged by the nobility and landed gentlemen of the counties they are bred in; but the fact appears to be, that they have already one of the finest breeds of cattle in the world upon their estates; and it behoves them to hand it down to posterity as pure at least as they received it. In this age of improvement, it might be laudable, he says, to endeavour to improve it to the utmost: not, however, by foreign admixtures; but by giving the most beautiful females to the most beautiful males of their own breed. They appear to him to have much to lose, but nothing to gain, from crossing, not even with the present long-horned breed of the inland counties. This species of Scotch cattle appears, he says, to be originally of the county of Galloway, which forms the southern extremity of Scotland; but they are now, it is said, propagated in other parts of the Lowlands, especially in the rich-land counties of the Lothians, in the neighbourhood of Edinburgh. He has known them fattened to eighty stones; and has been informed, from authority which he has no reason to doubt, that they have been known to reach near one hundred stone, of fourteen pounds each.

Lowland Scots are the ordinary breed of black cattle, in the Lowland counties, size below the Galloways, and appear to be a mixture between these and the Highland Scots. Sixty stone is a good weight for a Lowland Scot. In form and inclination to fat they partake of the Galloway breed: the former, however, is seldom so near perfection as that of a true Galloway Scot. Lowland Scots are some of them horned, some of them polled: their colour black, or brindled, or dun. The Highland Scots seem to be a distinct breed. The size is beneath that of the Lowland Scots: forty to fifty stone is the ordinary weight of a Highland Scot. In form, flesh, and fattening quality, the Highlanders resemble much the Galloway Scots, except that their backs in general are coarser, their bone proportionably larger, and in that they have, in general, but not always, horns of the middle size, and mostly bent upward, like those of the Welch cattle, but finer. In general appearance, there is a strong resemblance (their horns apart) between the Highland Scots and the black cattle of North-Wales; but with respect to flesh and fattening quality, the main objects, the comparison is greatly in favour of the Scotch breed, which the gentlemen of North Wales are said to fetch annually out of Scotland, or to buy them up at the English fairs, to be fattened for their own tables. The Isle of Sky appears to be only a variety of the Highland breed, contracted by soil, or climature, or both. They are, in point of size, the lowest in the gradation. But with regard to flesh, fattening, and growth while fattening, they may be said to stand foremost. He has known an Isle of Sky Scot, bought at two years and a half old, for less than forty shillings, reach, in about twenty months, to forty-five stone. At that age, says he, their growth in England is astonishing; owing, perhaps, not more to their nature, than to a change of climature, and a change of food. Much, however, depends upon their age. If they be intended for immediate fattening, four years old is the properest age. An Isle of Sky or a Highland Scot, at two or three years old, will grow, but he will not fatten; at five or six he will fatten, but he will not grow, while fattening, equal to a four-year-old bullock. At this age the weight of Isle of Sky Scots, when fat, varies from twenty to forty stone. These are the four species or varieties of cattle which are brought by the Scotch drovers to the Norfolk fairs, and which are bought up and fattened by the Norfolk farmers, under the foregoing names.

The following comparative statement of the process, expense, and profit, attending the fattening of three different kinds of Scotch cattle, grazed in Norfolk, is given by Mr. Burton, in the Appendix to the Agricultural Report of that county. "The first is a bullock bought at St. Faith's for about 9*l.* turned of four years old, in such condition as is fit to be put immediately to turnips—This bullock is supposed to be brought to from fifty to fifty-two stone. He is put to turnips for about twenty-four weeks, the average expense of which, including turnips, carriage, and attendance; and in case of bad weather, when a little hay is usually given, besides the straw, cannot be reckoned less than 4*s.* per week, this brings him to 13*l.* 16*s.*; and such a bullock generally will fetch about 5*s.* 6*d.* per stone of 14*lbs.* which amounts to 14*l.* 16*s.* The second bullock is bought quite lean, about the same time as the former, for about 6*l.* and is a year younger than the former. He is first put into stubble or ordinary grass till the straw-yard is open, and then he is put to straw at night, and eats the offal turnips after the better beasts in the daytime; his keep in this way, twenty-four weeks, till May-day, may be set at 1*s.* 6*d.* per week; he should then be put to marsh or into good pasture, till a fortnight after Michaelmas, which, say twenty-eight weeks, at 2*s.* 3*d.* per week, is 3*l.* 3*s.*; he then goes to turnips, like the former bullock, for eight weeks, at 3*s.* which is 1*l.* 4*s.*; his aggregate charge is then 12*l.* 3*s.*—his weight may be expected to be forty-four stone, and value 12*l.* 2*s.*

"The third is supposed to be bought at Harleston in December, a lean beast of the same age as the first, price 7*l.* He goes immediately to straw and offal turnips for about eight weeks at 1*s.* 6*d.* which is 12*s.*; then he goes to full keeping at turnips by day, and lies in the straw-yards at night, about ten weeks, at 2*s.* 6*d.* which is 1*l.* 5*s.*; he is then put into the second year's lay or good pasture till harvest, about twenty weeks, at 3*s.* per week, which is 3*l.*; this brings him to 11*l.* 17*s.*—he will then generally be about forty-six stone, at 5*s.* 6*d.* which will amount to 12*l.* 13*s.*

"The fair deduction to be made from this statement is, the writer says, that the first pays 10 per

cent. interest upon the capital laid out, and also a fair price for every thing he consumes.

"The second returns no interest for the original cost, but pays a fair price for what he consumes.

"The third pays 15 per cent. for the original sum laid out, besides paying like the rest for what he consumes.

"It should seem at first view of this statement, he thinks, that there is so little profit attending this system of grazing, that it is not a process to be recommended; but if we consider the advantage which the succeeding crops owe to it, in consequence of the great quantity of manure, to say nothing of the advantage of treading, which on a light soil is a vast thing, we shall be satisfied of the great advantage derived from it. It may not be amiss to observe, however, that it is obvious that the reason why the second does not pay in so large a proportion as the other, is owing to his being longer in hand."

Mr. Donaldson observes that, considering the early period at which the cattle of this country are generally slaughtered, it is not now of so much importance to lay down rules whereby to ascertain their age with precision, yet in many cases it must prove useful. The age of cattle, like that of horses, is discernible by their teeth. They lose the first foreteeth at the age of ten or eleven months: these are replaced by others of a larger size; and when about a year and a half old, the teeth next to those in the middle drop out. These are also replaced by others; and, at the age of three years, the others are renewed in like manner. They then appear white, even, and regular, and pretty long, becoming gradually black, unequal, and short, as the animal advances in age. Another mark, by which to determine the age of cattle, is the appearance of the horn. Cattle shed their horns at the end of three years; and, towards the root of the second set of horns, there is a kind of ring or joint, formed every year that the animal lives afterwards; so that, reckoning three years for the top, or plain part of the horn, and one for every interval between the rings or joints, the most ignorant person may, with considerable certainty, ascertain the age of any ox or cow that has horns.

It is remarked, by the author of the Agricultural Survey of the County of Stafford, where much valuable stock prevails, that it is a dogma almost established into a maxim by many experienced farmers of the old stamp, that "all breed is put in at the mouth;" whilst the modern breeder upon the Bakewellian system will boast, that the merit of his breed consists in their capability of doing well upon the least quantity of food of the ordinary kind. There is no doubt, says he, but both parties have wandered beyond the true bounds of nature; as all good stock must be both bred with attention and well fed; and perhaps it is necessary that these two essentials in this species of improvement should always accompany each other; for, without good resources for keeping, it would be in vain to attempt supporting a capital stock, and with such resources it would be absurd not to aim at a breed somewhat decent in quality. The cattle-stock of this county hath for years back been, and is at present, in some degree, improving; but all general improvements must be gradual, and a work of time. It is not in the power of every farmer, or even of the generality of them, to pay the prices for prime stock; and if they could, the improvement of their meadows and pastures should go hand in hand with that of their stock.

He adds, that the great object in the produce from horned cattle being, first, milk; second, beef; the uniting of these two products in the greatest quantity from the least food or produce of land, seems the ultimatum of breed. It has often been observed, that cows with the best disposition to fatten, not only give the least milk, but sooner go off their milking; whilst a loose, open, ill-made cow will both give a larger quantity, and continue it longer; but it is not so easily fattened, nor without much more time; the uniting of these two qualities in the highest degree is, therefore, the true desideratum of breeding.

It is also further remarked that those farmers, perhaps, who have not natural meadows, or streams of water to improve them, do not make cow-stock an object of much attention; and indeed, notwithstanding the plausibility of the theory, that a well-bred beast will do well on the worst soil, it will seldom be found, in fact, that good stock exists any where but where good keeping is found; and that, to maintain and improve such stock, the improvement of meadows aud pastures must be a primary object, and a supply of good summer and winter provision for such stock must be secured, before success can be expected in improving the breed; and farther, that stock and the land on which they feed, should have some analogy in quality, seems in part owing to physical as well as natural causes; for on a poor soil the occupier being, as it were, poverty-stricken, will have little of that energy, spirit of enterprise, and exertion, which are necessary towards insuring success in all attempts towards improvement; the necessary expenses towards which are only to be borne by those in easy circumstances, and which will seldom be the case with tenants at rack-rent on poor land. The next step towards improving stock, after providing for them the best keep circumstances will admit, is certainly by a selection of breeding stock; but this must be done by degrees; for the pecuniary circumstances of but few will admit of a total change. How much soever they may disapprove of what they have in possession, they can only object to a few of the inferior: this, however, is in their power; and, by always selecting the best for breeding and rearing, improvement will in time be effected. Great improvements in cow-stock are doubtless to be made by a proper selection of the best heifers in carcase and milk-bag for breeding-stock, but more particularly by a judicious choice of the bull—a principal mode to improve the stock on a farm. As what is called prime or first-rate stock is in but few hands, and the owners generally ask higher prices than farmers in general can afford to give, it would certainly be a laudable effort, if the owners of estates, by them-

selves or their stewards, would procure first-rate male animals for the best stock only of their tenants and neighbourhood, even if so much a-head were paid as would indemnify the expense; or if encouragement could be given by any public measure, by bounties, &c. &c. under the direction of the Board of Agriculture, for keeping the better sorts of each in regular districts, it would be a salutary plan, and might have a tendency to the improvement of live-stock; and it is only by some such or similar efforts, that the highest improvement to which live-stock is capable of being brought can be accelerated and effected. See *Breeding*.

In whatever way cattle are to be improved, there are a few circumstances in the management, besides those we have just noticed, that deserve the more particular regard of the farmer. The bulls should never be permitted to leap at too early an age, nor the heifers be suffered to take them while very young, as by such practices, which are too common in many districts, it is almost impossible that a truly valuable stock can be produced. The most proper ages at which cattle should be made to become productive, is a point that probably requires more experiments than have yet been instituted to ascertain it. And perhaps much may likewise depend upon the climate, situation, and the manner in which they have been reared and kept; as, where the situation is favourable, and the keep rich and good, they may be employed in this way earlier than where it is more exposed, and the keep indifferent. In general, perhaps, the third year may be the most suitable period; though, under favourable circumstances, it may sometimes be a year earlier.

Animals of the cattle kind are fit for procreation in, or indeed before, their second year; but they who aim at good stock, whatever they may do with their cows, should, at least, not make use of a bull until three years old. They should likewise be kept in the best manner, and in an inclosure by themselves, with the view of making the most of their vigour, introducing each female to them singly, in her proper season.

But where cows are kept merely for dairy purposes, and without any intention of rearing the calves, or upon the cheap plan of rearing, without regard to the quality or kind; the bulls, which are very inferior objects of consideration, it being simply necessary that the cows be served in due time, are generally suffered to go with the cows, and a single bull is sufficient for a very considerable number: and they are perhaps *segged*, or castrated, for fattening in their third years. And these animals are not injured by a little labour, while it has the good effect of rendering them more tame and gentle. They will retain their vigour till twelve or fourteen years old, or even longer; but are in their prime from three to six.

Neat-cattle live to the age of twenty years, and upwards, but their unfitness for grazing at an advanced age, usually occasions a period to be put to their existence before they reach their ninth year.

It sometimes happens that cows continue very unquiet without the company of a bull, leaping each other, and straining those which are in calf. In which case, great attention is necessary, when it is an object to keep the bull apart, and on the first symptoms, each cow should be presented to him. And "bullocks should not," Mr. Lawrence says, "be left in the company of cows, being apt to leap those which are bulling, injuring both the cows, and themselves. To present the cow to the bull, with a full udder, is a maxim, he says, the utility of which is confirmed by experience."

It has been stated by Sir John Sinclair, that "Mr. Bakewell used to put off sending his heifers to the bull till three years old; but his cows often missed calf, which might be owing to that circumstance. It is better, therefore, he thinks, to send them to the bull at two years old, and some recommend strongly even an earlier period. It is said that young cows, as early as even one year old, might be sent to the bull. If this would not stint their growth (which good feeding might obviate), it would, he thinks, be a great improvement, in particular cases, where the dairy was an object.

"In the northern counties, they wish their cows to calve when the grass is abundant. This, it is supposed, opens their milk-vessels, and is a great means of rendering them ever after good milchers; which is not the case, unless nature is early made to have a tendency to that species of secretion. It has been found a good plan, to give the whole of the milk a young cow yields to the calf, which she readily does, and thus gets into a good habit of milking. It has been remarked, that, if a cow goes beyond her time, she generally produces a male calf."

And "cows are not at their prime state for milk, he says, until they are six or seven years old, and they will remain so until they are twelve; but as the older they grow, the worse they will fatten, some farmers begin to feed them when they are from eight to ten, even though they are good milchers. The propriety of this system may, however, be questioned. Whilst the value of the udder, in a good dairy cow, exceeds the value of the cow, her pasture, and the necessary attendance, she may be kept to any age. The teeth, not the stomach, fail; and, therefore, as long as a cow milks well, she ought to be kept, as she can always be fattened by soft meat."

It is obvious, Mr. Lawrence says, that "cows in calf, without being made fat, should always have a sufficiency of nutritious food throughout both summer and winter; and, in the latter season, be sheltered from the inclemencies of the weather, in good fold-yards or sheds. Straw alone is of insufficient nourishment, and should be aided by hay, turnips, cabbage, or some species of winter provender. This additional expense is repaid by the superior condition of the cows, by the greater quantity and richness of their milk, and by the superior size and form of the young stock. However well shaped the original stock, the produce will ever degenerate from the meagre and insufficient keep of their parents, nor can it be fed so early or so quickly. The standard size will diminish, the legs increase in length, the form become irregular, and the muscles lose their plump-

ness. From the various abortive attempts we witness, it is necessary, he thinks, to give a caution respecting half measures, whether of the stock itself, or of their provision or management; such may possibly make proportional approaches towards perfection, or first-rate quality, but it ought to be obvious, can never reach them."

And he adds, that "the cow, like the mare, experiences her periodical desire for the male, indifferently at any season of the year; but in breeding calves for rearing, it is doubtless preferable to adopt the system of the stud, and so manage, as to have them dropped in the beginning of the warm season, and during the growth of the spring-grass. Winter rearing is expensive, and all young animals are tender, and injured by cold. In cow-keeping, purely for the sake of the milk, the case is different, and no opportunity should be passed of the cow receiving the bull, since the object is to renew the milk, as often as possible, and since fresh milkers are equally desireable, in winter, as in summer. The cow, well kept, will seldom miss her periodical heat, the first access of which is usually soon after her calf has left her." Nor should the cow, says he, which is desired to remain in perfection, either for milking or breeding, be exhausted by drawing her milk too long after she becomes heavy with calf, it is to pay too dear for a present supply of milk. She should, he thinks, be suffered to go dry, at least, two months before calving." In this however much depends upon keep, as where it is good, the milking may be extended longer without injury.

It is suggested, that "in some butter and cheese dairies, they rear a part of their stock. Where they rear all, there is yet a surplus of milk to be converted to some purpose of profit, and this surplus may be used in the rearing of purchased calves, by which means, a farmer may rear annually double the number. It is true that, in some poor and mountainous districts, the native breed may afford so little milk, that the cow's produce is barely sufficient for the maintenance of her calf; in which case, the calves ought to suck their dams, constantly accompanying them, until they can be sustained by grazing, when no time should be lost in their separation, that the cow may be ready to receive the bull."

The author of the Treatise on Cattle considers it "absolutely necessary, for the prevention of accidents, and in order to the best management, that memorandums be made of the day on which the cow received the male; the day, also, of her bringing forth, should, he thinks, be regularly noted, as a future guide, and for other useful purposes. Where much breeding-stock is kept, a *stud-book* is indispensable, and it may serve for every species, neat-cattle, horses, sheep, and swine, not only for the entry of breeding dates, but of various other useful momorandums." And "the progress of the cow in her gestation being duly watched, every needful assistance may be administered to her, immediately before, and at the critical moment of parturition. It is the custom in some parts, he says, to decrease the quantity or quality of keep, a few weeks previously to the cow's calving, with the view of lowering her condition, least her being too full of flesh may be an impediment to her delivery, by narrowing the circumference of the passage. He is led, both by theory and observation, to disapprove this practice. It appears to him, that by reducing the keep, we also reduce the muscular powers of the animal, and thence the energy of her throes, so necessary to the ejection of her burden; and the greater number of difficult births which he has noticed, seem to have proceeded rather from weakness, mal-conformation, or over-driving, by which the calf may have been disturbed, than from fullness of flesh. Nothing, however, can be more improper, on various other accounts also, than over-fatness in the female, and it is a strong objection to those breeds, which have so great an aptitude to fatten, that they are uncertain in procreation, and fall short in quantity of milk, one of the most precious of nature's productions. A judicious farmer will preserve a proper medium in this affair, by observing with the females of whatever kind, such a regimen, in respect to keep, as will impart to them sufficient nutriment, without overloading them with fat: as to the too contracted form of the *pelvis*, in certain breeds of individuals, it admits of remedy, he supposes, by improving the form of the breed, and by imparting a greater capacity to the hinder parts."

The same writer observes, that "there is nothing of which long and repeated experience has rendered him more certain, than the gross folly, as well as inhumanity, of suffering our domestic animals to bring forth in exposed situations, and subject to the injuries of wet and cold. It is in the warm season only, that they can remain, with safety, unsheltered. In winter, spring, and autumn, out-houses, sheds, or well-sheltered fold-yards, are the only safe and proper places; and in case of cold rains or piercing winds, even in any season, a covered place is preferable. As may be rationally expected, from so great a change, all new-brought-forth animals are extremely susceptible of the impressions of cold, as are also the dams, from the indirect or temporary debility induced by the act of bringing forth. Now although numbers escape, by virtue of the common chance, through which other perils are avoided, yet many of the young animals fall an immediate sacrifice, and more are, in consequence, afflicted with latent disorders, which militate greatly against their future improvement: and although the dams are not so often fatally affected, they very frequently sustain injuries from which they are never afterwards thoroughly recovered. *Milk-fever, retention of the after-burden, or cleaning, peripnuemony, chronic cough, and a species of consumption, attended with the symptom called hide-bound, staring of the coat, and falling away of the milk*, are the maladies which he has too often had occasion to attribute to the above origin. It is a fallacy, natural enough, he acknowledges, that exposure to all the risks of climate, contributes to the hardiness of live-stock. But whoever will take the trouble of the experiment, will, he thinks, be convinced that gradual exposure

is not only more safe, but far more contributory to the desired end than the abrupt and sudden change. The analogy of wild animals is not, he thinks, fairly stated; an important member of the proposition is overlooked; the numbers which perish from the inclemency of the seasons are not noticed, which, by domestic care, might be preserved, and yet afterwards gradually inured to cold, and rendered fully equal in hardiness to those which have survived the risks of being reared in the natural state. It farther deserves consideration, that there are ever individuals of such as are esteemed the most hardy breeds, which no possible means will render equal in that particular, to their fellows, and which yet, with proper care, may be rendered equal to them in profit." This is a point for the exercise of judgment in the stock-farmer. See *Cow* and *Cow-keeping*.

In respect to the working of oxen, "the supposed necessity of beginning to feed them at an early age, is a great objection," Sir John Sinclair says, "to their being generally used, as they are hardly trained properly to work, before it is thought necessary to fatten them, after which they do very little work; but, in consequence of the improved mode of fattening by oil-cake, &c. there is no difficulty to fatten oxen, even at twelve years of age, which is a material circumstance in their favour.

"It is thought best to begin to break in oxen, he adds, at three years old, and to give them full work at four. In the northern counties of England, four oxen are commonly used, the two foremost in harness, the other two in yokes. In Scotland, it is not uncommon to work two oxen in harness, and without a driver. They are sometimes worked till they are from eight to ten, and even twelve years of age; but it is generally considered to be more profitable to begin to feed them earlier. Some people, says he, prefer *free martins* and spayed heifers, for working, to oxen. They are found very strong and active; and, it is said, they will, with equal feeding, work nearly as well as a horse." And "it is a remark of the late Sir Charles Turner, that the advantage of working oxen depended much upon the breed; and he preferred much the Lancashire sort, as they were not only active and hardy, *but lengthy, in the carcase*, which enable them to go four inches further each step, than almost any other kind." See *Ox*.

Draught-Cattle, such sorts of cattle as are employed in labour, either in the field or on the road. They are mostly bulls and oxen, though in some places the heifers are likewise employed in this sort of business. See *Ox* and *Team*.

Cattle-*Farm*, that sort of farm in which the produce of cattle, in one way or other, form the principal object of the occupier. They are of various kinds, according to the system of management that is pursued upon them; as *breeding*-farms, in which the main object of the farmer is the breeding and rearing cattle for the purpose of the grazier, or some other particular purpose; *dairy*-farms, in which the chief intention of the farmer is milk, butter, or cheese, the first being sometimes termed cow, or milk-farms; *grazing*-farms, in which the fattening different sorts of cattle-stock for the market is the principal point aimed at; and *suckling*-farms, in which the fattening calves for the butcher is the primary consideration. The farms, where neat-cattle are employed in labour, are sometimes called cattle-farms. See *Farm*.

Cattle-*Sheds*, are such erections as are made use of for the purpose of containing cattle while feeding or otherwise. They are the most readily and cheaply constructed when placed against other offices.

Buildings of this kind may be used as cow-houses or feeding-houses, being built to answer either one purpose or the other. They are either single or double; in the latter way a great many cattle may be accommodated at a very small expense. The principal requisites in these buildings are, according to Mr. Beatson, the following: 1. That they be capable of being well aired. 2. That they are so constructed as to require the least possible labour in feeding the cattle, and clearing away the dung. 3. That the stalls be so formed as to keep the cattle as dry and clean as possible, with sufficient drains to carry away, and reservoirs to collect, the urine and dung. —He observes, with regard to the first requisite, that a free ventilation is as necessary in these buildings as in stables. How often do we see, says he, on entering a house where there are a good many cattle or cows, most of them perhaps in the highest state of perspiration, and smoking as if they had been at the hardest labour! at the same time, the whole timbers of the roof are completely wet by the condensed fumes arising from the heat and breath of the cattle. This can only happen in close buildings, which must undoubtedly be extremely unwholesome; and, he supposes, must prevent the cattle thriving so well as they might otherwise do. To a feeder of cattle, says he, who looks eagerly forward to the profits he is to reap, and who estimates every additional pound of weight that a bullock ought to take on each day, it would be well worth his attention to consider, whether any bullock, in a perspiring state, can fatten so well as when kept in a proper degree of temperature. He thinks it stands to reason he cannot. When such buildings are in the form of sheds, they are not so liable to this want of ventilation; but wherever the timbers above appear wet by the heat of the cattle, it is an evident proof there should be some additional air-holes, which, in his humble opinion, ought principally to be in the roof, as recommended for stables. If there are gable ends, they should have a window in each, as high up as possible, with moveable boards as in granary-windows, which may, by means of a cord or small rod be easily opened or shut at pleasure. The advantages of this free and wholesome ventilation to the cattle must be very evident, and also to the preservation of the timbers of the building; for where the timbers are often wet in this manner, they cannot be of long duration, consequently the expense of repairing or renewing them would be greatly increased.

In regard to the second qualification, there are various constructions of these buildings, but chiefly

in the interior part. In many, the cattle are fastened to stakes ranged along the wall at the distance of about three feet from each other, with a space of eighteen or twenty inches between the wall and the stakes to lay their food in. This is a very general construction in many parts of the country; but it is somewhat remarkable in this as well as in many other things, that the plan most generally followed is the very worst that could have been thought of; according to this construction the feeder, except sometimes, when the cattle are fed from without, is obliged to go in among them to give them their food, which occasions a great waste of time, as well as being attended with many other inconveniences. No construction can be more commodious than when a sufficient space is left before the cattle, for the feeder to go with a large wheelbarrow to distribute their food. This may be obtained either in single sheds, or in double ones, by making the cattle face each other, and leaving a free space of about four feet to admit a wheelbarrow.

The single ones may be formed as in *pl.* XV. *fig.* 1. *a* is the passage before the cattle. *b* the rack for their hay or straw. *c* a place for laying fodder or litter occasionally. Or it may be constructed as in *fig.* 2. *d* the passage. *e* a perpendicular rack, behind which are thin deals all along, in the position *f*, for laying the hay upon; and under *f* is a square hole *g*, opposite each stall, through which the cattle are fed from the passage *d*. This is a very good construction, and is taken from the new offices at Mr. Bishton's, of Kilsal, in Shropshire.

Double sheds may be constructed as in *fig.* 3. *a* is the passage. *bb* are the stakes to which the cattle are bound. *cc* are posts or pillars to support the roof. It might be an improvement here, he says, to adopt Mr. Bishton's plan, and make similar racks, with holes below, as in *fig.* 2. Another way of constructing these double sheds is shown in *fig.* 4. by which a very convenient loft may be obtained in the roof. *a* is the passage between cattle, and *b* the loft above, which, if close boarded, may serve many useful purposes. These double sheds are perhaps the best construction for feeding-houses, being not only the most commodious, but requiring less building for the same number of cattle, than by having them all to face one way.

It is justly remarked, that when cattle are fed from the outside through holes left for that purpose, many inconveniences may arise, either in wet weather, in a severe frost, or by a heavy fall of snow. When they are fed within, no sort of weather can occasion any interruption, especially if there is a proper place adjoining, to keep the provender in security and under cover. In single sheds it would be convenient to have a place above the cattle, as at *c*, *fig.* 4. for holding occasionally some hay or straw. This place might be boarded, and made to open from without by covers suspended on hinges, which, when opened, will afford an easy access for putting in the fodder from a cart. It would there lie ready for the feeder to throw into the racks when required. The roof is in this case to be supported by posts or pillars about three or four feet high, on the top of the wall, and placed about eight or ten feet distant from each other, as *aaa*, &c. *pl.* XVI. *fig.* 1. *bbb*, &c. are the hinges of the covers, and *ccc*, &c. rings to raise them up. *d* is one of the covers open, which may be held up in various ways, as by a catch *ef*, *fig.* 2. moveable on a small iron pin, the heaviest end *e* being within the fixed boards, and *f* without, to catch in a hole in the cover when opened.

Thirdly, great attention is necessary to keep cattle clean and dry. The common method of taking away the dung in wheelbarrows is attended with a good deal of labour, and, where there are many cattle or cows, will require perhaps several men's attendance. If this labour can therefore be abridged, and one or two men's work saved by a proper construction of building, it will be a great advantage. This should be considered in the original design, before the building is begun, and must be determined in a great measure by the form and situation of the ground. If a proper receptacle can easily be had immediately behind the cattle, for throwing in the dung at once with a shovel, without wheeling it, this would be the easiest way, and will not only save labour and expense, but, if properly contrived, the dung will be the better for it.—By the common method, the dung is in general so scattered about and exposed to the weather, that a great part of its virtues is exhaled and lost—a matter of great importance to the farmer, for it is not merely the quantity, but the quality also of dung that is to be considered.

To preserve dung under cover would be attended with an expense, in the construction of a proper place, that perhaps few would choose to go to; at the same time, there is no object of more consequence to the farmer than preserving the quality of his manure.

The facility of keeping cattle clean and dry, depends very much on the construction and paving of the stalls, of which there are various kinds. In many places, however, there is no such thing known as a stall for cows or oxen, they being bound to stakes, without any division whatever betwixt them. In some parts, again, particularly in Cheshire and Lancashire, cows are bound in pairs, at least there is but a very small division betwixt them, as will be seen by *fig.* 3. which is a plan of these stalls, *aaa*, &c. being the stakes to which the cows are bound. In other parts, they are not bound at all, but every cow or ox has a separate stall, so divided from the rest by rails of wood, that they cannot get out, and so narrow that they cannot even turn about. *fig.* 4. is a plan of these stalls. *sss*, &c. are the stalls. *p.* is the passage betwixt them. *tt*, &c. are the troughs out of which the cattle feed. *fig.* 5. is an elevation of the rear of these stalls. *r* is a rail that lifts out at the end of each stall. Sometimes there is a little door that opens as at *g*. *fig.* 6. is a section of these stalls, in which it will be observed, there is a short rail or brace at *a*, to prevent the cattle touching each other with their horns. Some people are of opinion, that cattle feed much better and quicker in stalls of this kind, than when they are bound.

Double-stalls may be made without the short division, as already mentioned. The division between them, however, ought to be sufficiently boarded at the top, to prevent the cattle seeing their neighbours in the next stall. At each stake should be a trough for holding meat, and between these two troughs, another one, common to both cattle, for holding water, with which it may be supplied by a pipe communicating with a cistern or reservoir without. These three troughs may be of stone, as in *fig.* 7. and all of one piece, if thought proper. A perpendicular rack for holding hay or straw may be placed over them, as represented in *fig.* 8. which is a section or view of one of the stalls, and *fig.* 1. is a plan. Perhaps it would be an improvement to divide them by a rail in the middle, as at *ab*, *fig.* 7. which would prevent the cattle turning too much about, and spreading their dung over the whole stall, for the more they are made to dung in the same place, the easier it will be to keep them clean. But although the double stalls here recommended are a good deal used for milch cows, in different parts of England, yet they have, in general, only one trough for each cow, without any for water; nor, indeed, has he seen any with this conveniency, except at Burleigh, in Rutlandshire, a seat of the earl of Winchelsea, whose offices and farm-houses are on an excellent construction, being planned chiefly by himself.

In paving stalls for cattle, he remarks, that there is generally too great a declivity made, which will cause them always to stand uneasy and uncomfortable; for, when feeding, there cannot be too much attention paid to their ease and comfort, as well as to their food. If they are constantly wet and dirty, or in pain by standing in an unnatural position, it is impossible they can thrive so well as otherwise they might. Yet how little attention is there in general paid to this. One would almost be led to suppose it is the opinion of many, that if they stuff their cattle quite full of food, whatever may be its quality, it is all that is necessary. Sometimes they are chained so close to a stake that they can hardly move: nay, it is a practice, in some places, to fasten their heads between two stakes, by which they can neither lie down in comfort, nor can they have it in their power to destroy or dislodge those teasing tormenting vermin which frequently prey upon them. Besides this, they are often suffered to be besmeared to the back, and either smoking with heat for want of ventilation, or shivering with cold. No animal can thrive well under such mismanagement, let his food be ever so plentiful, or of so good a quality; for, as an ingenious author says, to keep cattle clean and well littered is to them half food. Cows are more easily kept clean than oxen, for they do not wet their stalls so much; but even oxen, when confined to stand nearly in the same place, cannot wet their stall above half way up, if properly constructed, and that generally about the middle. It is therefore clear, that if the moisture is immediately conducted away, and prevented from spreading, the ox will be easily kept dry. The best way to do this, is, he thinks, in the manner described for paving the stalls of stables. See *Stable*.

Stalls for oxen or other cattle should be paved in the same manner; but as their dung is of a more liquid nature than that of horses, it would be proper to have some commodious method to carry it off. Perhaps, in some situations, where there is a proper declivity, this might be done by having an iron grating behind each ox or cow, immediately over the stall drain, and as nearly as can be judged to the place where the dung will drop, which, by continuing the drain, or a wooden spout, to a pit or reservoir without, and giving it a sufficient slope, will, with the assistance of the other moisture, run and empty itself therein. If it should require the aid of a broad rake or hoe fitted to the drain, that may easily be applied, especially if those drains are made open and covered with a strong plank, to take up when necessary. The moist dung being thus carried away, the remainder will be easily removed. Something of this principle, suited properly to the situation of the place, would, he thinks, save a great deal of labour, and very much facilitate the keeping of the cattle clean; and also be the means of saving a great deal of litter, when scarce or dear. The advantage of proper drains, to carry off the moisture from within the offices, and reservoirs for collecting it in, are, therefore, very obvious, as, without such drains, it cannot be expected that the offices, or the cattle within them, can be kept sufficiently dry.

The author of the Treatise on Cattle remarks, that "ox-houses, for feeding cattle in stalls, ought to be provided upon every considerable farm; in defect of which, an incoming tenant ought, in justice to the land, as well as himself, to stipulate for such a provision. The erection for this purpose, at Hafod, in Wales, the residence of Thomas Johnes, Esq. M.P. for the county of Cardigan, and one of the most eminent improvers of the present time, seems, he thinks, to be calculated upon a moderate scale. The whole length of the building is fifty feet, the roof shelving, its chief height being fourteen feet, the lower extremities, one seven and a half, the other six feet. A stone wall, running up to the summit, parts the feeding-house from the other and smaller apartment, which is a receptacle for dung. The width of the feeding-house, nineteen feet within side. The stalls, each twelve feet long, by four feet two inches wide. The gangway, three feet and a half at the heads and tails of the cattle, leading from the doors; the first door being for the cattle, the other for the attendants. Similar doors at the opposite ends of the building. Running water in troughs; racks and mangers. The cattle lie on wooden platforms, perforated for the passage of the urine. The urine runs, and the dung is pushed, through apertures in the wall, each of which is two feet square, and one between every two stalls. There are twelve wooden flaps or windows, to give light and air to each stall. The dung-pit is about twelve feet wide, sunk some feet deep in the earth, extending the

whole length of the building. The walls are partly built with stone, and in part with wood; the roof with larch-wood, as an experiment of its durability in that exposure."

But he conceives, that "the rotunda, or quadrangular form, might, perhaps, either of them, be more economical of space and materials for a building to contain a considerable number. The oxen would most conveniently stand around, with their tails towards the wall, contrary to the usual practice, for the more easy throwing out the dung from a gangway, through apertures purposely made in the wall, into a pit under cover, sunk around the building. The area within, would, of course, be for feeding, and every necessary purpose of attendance. A store-chamber above completes the building; the chief objection to the form of which is, he says, the greater expense attendant upon the reversed position of the cattle; which, perhaps, is compensated by the great saving of labour, in the more easily getting rid of the dung. The gangway next the wall will, in course, be sufficiently wide to admit the beasts to and from their stalls; the dung apertures in the wall may be closed in cold weather."

The ingenuity of invention has suggested many other plans for buildings of this kind; but they must, in general, be regulated by the nature of the situation.

CAUDEX, a term which, by some early writers, signifies the stem or trunk of a tree; but, according to the later ones, the stock or body of the knot, part of which ascends, and part descends.

It is observed, by the author of Phytologia, that the part which joins together the plumula or leaf, and the radicle or root fibres, is called the caudex, when applied to entire plants; and may, therefore, be termed *caudex gemmæ*, when applied to buds. In herbaceous plants, the caudex is generally a broad, flat, circular plate, from which the leaf-stem ascends into the air, and the radicles, or root fibres, descend into the earth. Thus the caudex of a plant of wheat lies between the stem and the radicles, at the basis of the lowermost leaf, and occasionally produces new stems and new radicles from its sides. Thus the caudex of the tulip lies beneath the principal bulb, and generates new smaller bulbs, in the bosom of each bulb-leaf, besides one principal or central bulb; the caudex of orchis, and of some ranunculuses, lies above their bulbous roots; whereas the caudexes of the buds of trees constitute the longitudinal filaments of the bark, reaching from the plumula or apex of the bud on the branch, to the base of it, or its root-fibres, beneath the soil. Nor, continues he, is this elongation of the caudexes of the buds of trees unanalogous to what happens to some herbaceous plants, as in wheat; when the grain is buried two or three inches beneath the soil, an elongation of the caudex occurs almost up to the surface, where another set of fibrous roots are protruded, and the upright stem commences. The same happens to tulip-roots, when planted too deep in the earth, as he has witnessed, and, he supposes, to those of many other vegetables.

And, it is further remarked, that this caudex of the buds of trees not only descends, as above described, but also ascends from each bud to that above it; as on the long shoots of vines, willows, and briers, in this respect resembling the wires of strawberries, and other creeping plants. Thus the caudex of perennial herbaceous plants consists of a broad plate, buried beneath the soil, to protect it from the frost; while the caudex of buds of trees consists of a long vascular cord, extending from the bud on the branch to the radicle beneath the earth, and endures the winter frosts without injury. The long caudexes of the individual buds of trees, which constitute their bark, are, he says, well seen in the cloth made from the mulberry-bark, brought from Otaheite. On inspecting this cloth, the long fibres are seen in some places to adhere, where it is probable they occasionally inosculate, like some of the vessels in animal bodies; because, when some buds are cut off, the neighbouring ones flourish with greater vigour, being supplied with more of the nutricious juices.

This, says he, informs us, why the upper lip of an horizontal wound, made in the bark of a tree, grows downwards with so much greater expedition than the under one grow upwards to meet it; as the descending caudexes of the individual buds are supplied directly with nutriment from the vegetable arteries after the oxygenation of the blood in their leaves, whereas the under lip of the wound is nourished only by the lateral or inosculating vessels; which he thinks supplies us with an argument against the individuality of trees, and in favour of that of buds.

CAUF, a provincial word, signifying a calf.

CAUKER, in *farriery*, a term employed to signify bending or turning-up of the heels of the shoes of horses, and meant to prevent the animal from slipping. This method, though formerly universally in practice, is now generally limited to the outside heel of the shoes of the hind feet. Caukers have been considered as injuring the natural motion, elasticity, and expansion of the foot, and of destroying the healthy use of the frog and the bars; and, also, as having frequently been the cause of quittors, and other inconveniences, from horses with shoes of this description being particularly liable to wound the coronet and cartilages.

CAUMERIL, a provincial term, applied to the gambul used in killing sheep, hogs, &c. which has a crooked form.

CAUSTIC, in *farriery*, a substance which, by its great operation and activity, destroys the texture of the part to which it is applied. It has, in short, the effect of eating into, or burning the flesh into a sort of eschar, which in a little time falls quite off, and leaves a vacuity in the part. Caustics are of use generally in abscesses and imposthumations, to eat through the integuments, and give vent to the matter; also to make issues in parts where cutting is difficult or inconvenient. The actual cautery is, however, more commonly used in veterinary practice. See *Cautery*.

CAUTERY, in *farriery*, a name given to a red-hot iron, used to destroy fungous flesh, &c.

It is also sometimes employed to denote the searing, dividing, or corroding, by particular means, different parts of an animal. It may be effected by chemical preparations, or by heated iron: the latter method is termed the *actual* cautery. It is employed with advantage as a means of producing adhesion, where a cavity has been exposed; but, at present, is much less in use than formerly. "The operation of firing, according to Mr. Lawrence, is made use of in relaxation of the tendons, from sprains, and long and violent exercise. It is supposed to act as a bandage, from its contracting the dimensions of the skin, and causing a considerable and equal pressure on the internal parts. Upon this principle, colts intended for the turf are frequently *fired* when very young, to prevent what is termed *breaking down*; but it may be doubted whether, in thus contracting the skin, the freedom of the action of the limb is not more injured than the animal is benefited by this artificial addition to its strength. Where blisters are considered not sufficiently powerful, firing is employed; as in spavins, splints, curbs, windgalls, and weaknesses of the joints. It is also used in the operations of *docking* and *castration*, in the removal of glandular enlargements, and of the lampas; and, by some, to cause a speedy determination of the blood to particular situations, as the extremities in internal inflammations, &c. After the operation of firing, where the case will allow of it, the animal should be frequently walked gently about; and if he can be turned loose into an open stable, or, when the weather is favourable, into a field, it will considerably alleviate the pain and stiffness that he necessarily experiences. When horses are *turned out* after firing, the practice of applying *cold charges* is unnecessary and absurd: blisters, however, may be used with great propriety. It has been disputed, he says, whether the operation of firing is the most effectual with the straight line, or in the feather-like manner: in his opinion, each advocate may indulge his fancy with pretty nearly the same advantage." In managing this business, much more attention is necessary than is generally bestowed.

CAUTING-IRON, in *farriery*, an iron with which farriers sear those parts of a horse, or other animal, that require burning.

The edge of the iron should not be too thin, but rather blunt than otherwise: the heat employed should be the *red*, and should never approach to that of the *white*. When the instrument is taken from the fire, every extraneous particle ought to be removed, by lightly rubbing the sides on some smooth substance: this caution may prevent many little inconveniences. The mechanism of the iron should be such as to assist, as much as possible, the firmness and steadiness of the hand of the operator.

CAVE, a provincial word, signifying to rake off or from; as short straws and ears of grain, from the corn in chaff on the barn-floor.

Cavings, the rakings thus obtained.

Caving *Chaff*, the coarse chaffy materials collected in the above manner.

Caving *Rake*, a tool employed in this operation; a sort of barn-floor rake, having a short head and long teeth.

CAVESON, or *Cavezon*, in *horsemanship*, a term applied to an apparatus, resembling the musrol, which is used in the breaking of horses. From its formation, it binds and pinches the nose, and regulates the action of the animal to which it is applied. The caveson was originally made of strong twisted cord; afterwards of chains of iron, with sharp saw-like teeth; but, whenever iron is now employed, the teeth are omitted, and it is usually covered with leather, or other soft substance, to prevent its injuring the animal.

CAZZONS, a provincial word used to signify the dried dung of cattle, for fuel. It is commonly used about Holderness, in Yorkshire.

CELLS, the small divisions in honey-combs, which have been observed to be always regular hexagons.

They also denote the hollow places between the partitions in the pods, husks, and other seed-vessels of plants.

CENTAURY, the name of a weed or plant, abounding in arable and other lands, and generally called blue-bottle. See *Blue-Bottle*.

CERES, a term applied to a pagan deity, the goddess of corn.

CERT-MONEY, a fine paid yearly by the residents of several manors, to the lords thereof, and sometimes to the hundred, for the certain keeping of the *leet*.

CHACK, in *horsemanship*, a term used when a horse is said to chack, or *beat upon the hand*, when his head is not steady, but he tosses up his nose, and shakes it all of a sudden, to avoid the subjection of the bridle. In order to fix and secure his head, it is only necessary to put under his nose-band a small flat ligature of iron, bended archwise, which serves as a martingale.

CHAFF, the husks of corn, which are separated by threshing and winnowing. It also sometimes signifies the rind of corn: thus, barley that has a thick rind, is said to be thick chaffed. And it likewise implies straw, &c. cut small, for the purpose of being given to horses and other cattle, mixed with corn. This substance, whether obtained by the dressing of grain, or made from straw and other matters by cutting, is highly useful in the feeding of horses and other animals, as saving much other more valuable food.

It is said to afford not only fatness, but a fineness or sleekiness of the skin; which is probably produced by its contributing to a more perfect mastication of the grain, and a more intimate mixture of the saliva, before it is swallowed.

It is observed, by Mr. Young, in his excellent Calendar of Husbandry, that "the practice of cutting both hay and straw, for all sorts of stock, is one that has been found very important by many

practical and intelligent cultivators of great experience. General observations are not so satisfactory as comparative experience; but there are not many persons who have opportunity, time, and power, to compare the food and labour of two different teams, the one fed in the common way with hay, and the other with cut chaff, half or one-third straw. The opinion of the best informed persons is decidedly in favour of the latter. However, if racks are permitted in a stable, it is not an easy matter to prevent horse-keepers from cramming them full of hay, and especially at night. The best contrivance he has heard of, to supply the place of racks, was that of Mr. Vancouver, who made a sort of hopper the whole length of the manger, which delivered chaff from a loft above it, gradually, as the horses moved the lower lip of the hopper with their noses, in this manner supplying themselves; but a very intelligent nobleman trying it, found, he says, that it would not deliver regularly: this might arise from the dimensions not having been sufficiently attended to; for, if the hopper be not of a due breadth, the chaff might arch above the moveable board, and not come down: the aperture in the manger, through which it passes, must necessarily, he supposes, be of a certain size, neither too wide nor too narrow. It certainly seems, in his opinion, to be a practical idea, and very capable, after some trials and regulations, of being fully applicable to common practice. It well deserves attention, especially as the expense of an experiment for one stall could not be considerable. He has often determined to try it himself, but has always been prevented by some journey or excursion taking him from home, at the moment when he could, otherwise, have given the requisite attention. He conceives, that it would demand a manger from four to six inches wider than common ones."

But, says he, "the practice of giving hay cut with a mixture of straw, instead of feeding in the common way with hay, is to be recommended, at all events, to as great a degree as can be effected, for the saving is unquestionable. Nor is it to be practised for the teams only, but also for all other stock that eat hay. Mr. Page, of Cobham, he adds, in feeding his stock, gives no hay or straw but what is cut into chaff."

In using it "for sheep, attention must, he says, be paid to the troughs in which it is given, to see that they be so boarded as to prevent the wind from blowing the chaff out: this is effected in Lord Clarendon's sheep-yard, in Hertfordshire, he observes, by a semi-circular boarding, which covers the sheeps' heads while feeding in the troughs."

It has been asserted, that the nutritive property of this substance is increased by bringing a state of fermentation upon it.

Chaff-*Cutter*, an implement constructed for the purpose of cutting straw and other substances into chaff. Instruments of this sort are of different forms and contrivances. Mr. Cook has invented one which, by means of a man and boy, will cut one hundred quarters a week; and when fixed to a large wheel, and turned by an animal, such as a poney or ass, will cut half the above quantity per day. Another contrived by Mr. Nailor is capable of cutting three quarters an hour by the assistance of two men, and costs about ten guineas. An instrument for this purpose made by Mr. James Pike is both cheap, and of the most simple construction. It is fixed on a wooden frame, which is supported with four legs, and on this frame is a box for containing the straw, four feet six inches long, and about ten inches, broad; at one end are fixed across the box two rollers inlaid with iron, in a diagonal line about an eighth of an inch above the surface; on the ends of these rollers are fixed two strong brass wheels, which take one into the other. On one of these wheels is a contrect wheel, whose teeth take in a worm on a large arbour; on the end of this arbour is fixed a wooden wheel, two feet five inches diameter, and three inches thick; on the inner part of this wheel is fixed a knife, and at every revolution of the wheel, the knife passes before the end of the box and cuts the chaff; which is brought forward between the rollers, which are about two inches and a half asunder; the straw is brought on by the worm taking one tooth of the wheel every round of the knife; the straw being so hard pressed between the rollers, the knife cuts off the chaff with so great ease, that twenty-two bushels can be cut within the hour, and makes no more noise than is caused by the knife passing through the chaff. *a*, in *pl.* XVII. *fig.* 1. is the box into which the straw is put. *b*, the upper roller, with its diagonal projecting ribs of iron, the whole moving by the revolution of the brass wheel *c*, on the axis of which it is fixed. *d*, a brass wheel, having upon it a face wheel, whose teeth take into the endless screw on the arbour *e*, while the teeth on the edge of this wheel enter between those on the edge of the wheel *c*. On the axis of the wheel *d* is a roller, with iron ribs similar to *b*, but hid within the box. *e*, the arbour, one of the ends of which being made square, and passing through a mortise in the centre of the wooden wheel F, is fastened by a strong screw and nut; the other end of this arbour moves round in a hole within the wooden block *g*. *h*, the knife, made fast by screws to the wooden wheel *f*, and kept at the distance of nearly three quarters of an inch from it by means of a strip of wood of that thickness, of the form of the blade, and reaching to within an inch of the edge. *i*, the handle mortised into the outside of the wooden wheel *f*.

An improved machine of this sort has been invented by Mr. Robert Salmon, of Woburn, Bedfordshire, and described in the Transactions of the Society for the Encouragement of Arts. With it the chaff is cut by two knives, fixed on the inside of the fellies of two wheels, which are strongly connected together; the edge of the knives being at an angle of about forty-five degrees from the plane of the wheel's motion. These knives are so fixed as to be forced forward by springs on the wheel, which springs are formed to adjust, and act more or less, as occasion may require, so as to give the knives as much pressure against the box as may be requisite to cut the

straw. The knives are prevented from coming too forward, and occasioning unnecessary friction, by wedges being put in under the staples; which wedges, as the knives wear, must be drawn out so as to admit the knives to come more forward. With the before-mentioned provisions, it will be found very easy at any time to put on new knives, as the springs, &c. will always adjust them to their work.

On one side of the wheel is fixed a round block of wood, in which there are four holes and a moveable screw; to this block is screwed one end of the feeding-arm, running nearly horizontally to the cross bar, at the end of the box; to which cross bar there is a pin, moveable to five different holes, by means of which, and the four holes in the block before described, twenty changes in the length of the chaff may be obtained. The straw is brought forward by the rollers in the box, the form of which has been just described, which rollers are turned from the outside by the triggers or ratchet-wheels on each side of the box, which move more or less, according to the stroke given to the cross bar by the feeding-arm and wheel; by this mode of feeding, the straw is perfectly at rest, and does not press forward at the time of the knife cutting; and, by means of the pin being taken out of the cross bar, the feeding is instantly thrown off, although the wheel and knives may continue their motion. Under the box is suspended the pressing weight, which may be made more or less powerful by shifting the weight on the bearer to which it hangs, and also may be thrown on either side, more or less, as occasion may require; which will be found useful in order to force the straw towards the knife, and to counter balance the ratchet-wheel of the upper roller: near the fulcrum of this bearer is fixed a chain, the upper end of which is suspended from a roller, at each extremity of which is a small bar of iron joined to the end of the upper spiked roller, by which means the straw is always equally pressed in passing the two-spiked rollers. The winch by which the machine is turned is of the common kind, and the frame of the machine is to be made very firm and strong.

In order to apply this implement to the best advantage, the inventor proposes a second box, to be placed at the end of the first, which box may be of any length, and suspended by a line and counter-weight, whereby the end of it is brought down level whilst filling with straw, and then drawn up, so as to give the said box a declivity, to make the straw more easily come forward.

It is supposed that much advantage may be derived in this instrument, from its cutting various lengths—resting during the cut—the knives being adjusted to their work by regulating springs—the feeding being readily thrown off—and the pressure moveable to either side. It is also well calculated to be applied to any power which may be occasionally fixed to the opposite side to that on which it is turned by hand; and, by the additional box, when used by hand, the workman will be enabled to cut for some continuance, without stopping to feed. Where threshing-machines are in use, these implements may frequently be attached to them with great advantage. There are many other instruments of this sort constructed in different ways; but those which are the least complex, and can be afforded at the cheapest rate, are the most adapted to the purpose of the farmer. See *Cutting Box.*

The above machine, as considerably altered and improved by Mr. Rawntree, is seen in *pl.* XVII. in which *fig.* 2. is a side, and *fig.* 3. an end-view of it. The advantages of this implement are, 1st, its great simplicity; 2d, its cutting the chaff of various lengths; 3d, the straw being at rest while the knives are making the cut; 4th, the friction being less, more work of course may be done with equal labour.

A, the handle.

BB, the fly-wheels on which the knives are fixed.

C, the ratchet-wheels, and rollers for drawing the straw forwards.

D, the rods to work the ratchet-wheels, connected with the lever and crank.

E, the box for containing the straw.

F, the lever, and weight for pressing the straw.

G, the knives.

H, the crank for regulating the cut.

I, the frame.

An excellent machine of this sort has been invented or improved by Mr. M'Doughle, which is so formed, that, in case of its being accidentally broken, it may be repaired by any common mechanic. The pressure of the straw is also capable of being regulated with great facility. But the great improvement is in having applied a spiral grove, instead of the endless screw, by which friction is much diminished, and the lever may rise to any height, without putting the machine out of work. It is seen at *fig.* 4.

Mr. Young remarks, that "the number of engines which have of late years been invented for cutting hay and straw into chaff (most of which execute their work sufficiently well), leaves no farmer in the kingdom under the necessity of using the common chaff-box, worked by those only who have acquired the art of using it, and who usually made much greater earnings than the common pay per diem."

He adds, that Mr. Page, of Cobham, has, at the expense of only five pounds, added a mill-wheel to an implement of this kind, by which means a boy and a little poney cut twenty bushels of chaff in the hour.

Chaff-*House*, a house or room formed for the purpose of containing cut chaff. It should be situated as close to the barn and stable as possible, be perfectly dry, and, where the chaff is to be fermented, constructed of brick-work.

CHAFFER, a term applied to a species of beetle sometimes highly destructive to young plants. See *Cock Chaffer.*

CHAFING, in *farriery*, an excoriation or loss of skin from friction. It frequently happens to draught cattle, in consequence of some unequal pressure of the harness, and occasions them severe pain and inconvenience in the performance of their labour. Humanity requires, that particular care should be taken to prevent chafing from these causes,

which the poor animal can only make known by its wincing in consequence of pain, and sometimes refusing to draw. When it happens, the raw place should be secured from further rubbing, by bolstering the collar or harness by which the accident has been occasioned, with hay, wool, or some soft substance, so that the bearing shall be on a sound part. When this is done, the skin will soon be restored by washing with brandy, lead-water, or a weak solution of alum or blue vitriol, or by applying a plaster of any healing cerate or liniment.

CHALK, a calcareous substance, which, when pure, is of a white colour, moderate consistence, and dusty surface; stains the fingers, adheres slightly to the tongue, does not harden when heated, but, on the contrary, in a strong heat burns to lime, and loses about four-tenths of its weight. It effervesces with acids, and dissolves almost entirely therein. It may also be added, that this solution is not disturbed by caustic volatile alkali, as this circumstance distinguishes it from magnesia. It promotes putrefaction. In its native state, it is useful as a manure upon the same principle as limestone; but it is more easily pulverized, and lighter and more porous. Nearly the whole of it is calcareous earth; whereas no marl contains more than a fourth part of that substance. It is in high esteem in the southern counties of England, where it abounds. Its best effects are upon deep soils, which contain no calcareous earth. It is observed to have very little effect upon lands where the sub-stratum is chalk; and, if the soil be thin, it does mischief. When used upon light soils, it is made into compost with earth and dung. When this is well mixed and duly proportioned, it produces valuable crops, and its influence continues many years.

The common method of using this compost, is either to lay it upon fallows for wheat, and mix it intimately with the soil, or upon grass as a top-dressing; in both cases it answers well: in the latter it destroys moss, rushes, and all coarse aquatic plants that grow in sour or wet lands; in the former, it opens and pulverizes the soil, and never fails to produce good crops.

In making use of it, it should be broken as small as possible. It should be dug near the end of autumn, and laid on immediately: at that season, the air is generally moist; the moisture will be absorbed by the chalk; this will occasion it to swell and break in pieces, and, if frost come on, it will accelerate the business: but when it is dug in summer, it loses its moisture, and acquires a hardness, which in a great measure prevents it from being of any use. It should in no case be ploughed in till its parts are properly separated; and then it should be completely harrowed in, and mixed well with the soil.

If the soil be thin and light, a certain proportion of dung will be useful; but if it be heavy, the dung is said to lessen the operation of the chalk. It is generally thought, that lands which have been completely chalked, will not bear a repetition of it. A compost of it, however, may be used to great advantage. In the southern counties, a field has been chalked, and dressed with chalk and dung mixed, in pieces alternately: and the former has produced a very bad crop, and the latter a very good one. It is asserted, that, laid on beyond a certain quantity, it will not only cease to operate as a manure, but even prove hurtful. It ought, therefore, to be used with caution, and due pains taken not only to ascertain the strength of the chalk, but the quality of the soil on which it is laid.

Chalk is a lasting manure, when applied on suitable soils; which are those of a cold sour nature, as stiff untractable clays. Pliny tells us, it was the custom of the Ancient Britons to chalk their lands, by which they received a great and lasting improvement.

The different kinds of chalk should be distinguished by the farmer. The hard, dry, and firm, is much the fittest for burning into lime; but the fat and unctuous is by far the best to be used crude.

In some parts of Essex, they lay from five to eight waggon-loads of chalk on an acre, either upon a clover-lay while feeding, or on a summer fallow: a very thin dressing of it is seen immediately to an inch, like rotten dung, and lasts twenty years, fifteen in good heart. The soil is loam; they have a little clay, and no sand: on gravels the effect is but slight. They bring the chalk from Malden, whither it is brought by sea from Kent; and a waggon-load costs 10*s.* at the quay. It is rather hard; the sharpest frosts leave many lumps unbroken; these they break with pick-axes. The effervescence with vinegar is pretty considerable, but in water it scarcely falls at all. It is also a general opinion, in that county, that land which has been once chalked will not take it again: they acknowledge, however, that, mixed with earth and dung, it is then excellent. They observe, that laying a slight dressing of chalk and earth, or dung, on a field never chalked, will take so much effect, that the same field will not answer to chalk completely. They observe, also, that the chalk presently gives the land a red colour. They are of opinion, that chalk is a great enemy to good grass; and affirm, that a field which, before chalking, will run of itself to a fine head of white clover, no longer does it after chalking. There is no saying any thing against experience: we should not, however, draw general conclusions from partial experiments. Much of the effect of manures depends upon the soil on which they are laid. About Enfield, as observed in the Annals of Agriculture, the same chalk does wonders, which, at North Mims, has very little effect:—the one is a rich loam, the other a poor gravel. And near Sandwich, in Kent, chalk has been found, in a very high degree, to improve a sandy soil, giving it tenacity, and totally exterminating that pernicious weed the corn-marigold, provincially called *yellow bottle*, *buddle*, or *golds*, so abundant in sandy soils. They lay on forty loads, of forty bushels each, to an acre. Upon pasture-land it does nothing. In Hertfordshire, it is thought that chalk makes the land plough much better, and renders all manures much more effectual. If a field be divided into parts, one chalked, a second chalked and manured with dung or soot, ashes, &c. and a third

dunged or ashed without chalk; although chalk alone has no effect, yet the other manure on the chalked part will have a much greater effect than on the part where no chalk is laid.

The author of the Synopsis of Husbandry observes, that "this manure, though it falls infinitely short of marl in its fertilizing quality, is nevertheless possessed of virtues which deservedly entitle it to the esteem of the farmer. By a proper application of this substance, the most tenacious clays are rendered friable and mellow; and thus their native stubbornness and adhesion being overcome, the several particles of the soil are enabled to imbibe the full benefit of the different changes of the atmosphere; and hence they are brought to work kindly under the several operations of the plough, harrow, &c. and to produce ample crops of grass or corn, which, before the application of this manure, they were incapable of bringing to perfection. So great are the benefits accruing from this manure, when laid on a stiff clayey soil, that the Essex farmers find their account in freighting barges from the chalk-cliffs in Kent, and afterwards carrying it with their teams several miles up the country; all which, though attended with a heavy expense, is found to answer the purpose extremely well, as it would be impossible to reduce these stubborn clays to a proper tilth without the previous application of this manure. Nor is it on clays only where chalk may be laid to advantage; gravels, especially those which lie near the springs, and all wet soils, may be dressed with this manure, which will never fail to meliorate and sweeten the ground, and enable it to retain longer the virtues of the dung that may be applied, which, on these hungry soils, is liable to disappear in a short time: nay, so partial are some farmers to the use of this manure, that he has known it carried on soils where the chalk lay within a few inches of the surface."

The action of chalk on the soil is either chemical or mechanical. It acts chemically as an absorbent, contributing to preserve dry those lands which are poachy and wet; and by its attraction for acids, it may hasten the putrefaction of vegetables. It acts mechanically, by entering into the composition, and totally altering the nature of clay, converting it by proper pulverization into a species of marl. By insinuating itself between the particles of clay, it destroys their adhesion; thus preventing it from becoming too hard in summer, and too wet in winter.

Mr. Bannister says, there are two methods of obtaining chalk. "The first is, by uncallowing a piece of ground, and making it convenient for a pit, where the carts may be drawn into it, and filled: this is on a presumption that the chalk lies near the surface, and that the pit is within a small distance of the field on which the manure is to be laid. The other method is, to sink pits in the field where the chalk is intended to be laid as a manure, and which, in his opinion, is far preferable to that of drawing it in carts, as before-mentioned. In this case, a number of pits are to be sunk, according to the extent of the field. These pits are to be made in the form and circumference of a well, with an apparatus at the top, and a bucket to draw up the chalk. The people who undertake this business, having been brought up to it from their cradle, perform it with great facility, and without any timidity, though attended with much danger. A person is employed at the top, to draw up the contents of the pit, shoot the chalk into the cart, and wheel the same on the land. When the labourer has arrived at the chalk, which takes up a longer or less distance of time, according to the depth at which it lies, and has dug some little time therein, in the perpendicular form wherein he began the pit, he proceeds to form apertures in different horizontal directions; so that, where the chalk is good, and the pit stands firm, large tracts of ground are undermined for this purpose. The price for digging chalk is 1*s.* per foot, till the chalk be found; after which, for the chalk, 1*s.* per load, which is twelve baskets; and 1*d.* per load for wheeling the chalk on the land, the farmer providing a horse and cart for that purpose. The quantity usually laid on an acre, is from eighty to a hundred loads.

"From this description of chalk-drawing, he says, it is evident that much care and circumspection is required, to prevent any deceit being imposed on the farmer by the workmen, to which their eagerness of acquiring large wages will be a powerful inducement.

"The best chalk is that which is white and hard; and the deeper it lies beneath the surface, the more efficacious is the dressing supposed to be, as partaking less of the nature of the soil whereon it is to be applied as a manure: indeed, on a clayey soil, it is seldom to be met with but at a considerable distance beneath the surface of the field. The most eligible season, he says, for the performance of this work, is in the early part of the winter, as the chalk which is laid out at that season will, by aid of the succeeding frosts, be in a great measure meliorated and reduced to crumbs, at the time of fallowing in April: whereas, should the business be deferred till the spring, no inconsiderable portion of the chalk will remain in lumps till the next winter. From this neglect, a twelvemonth will be lost in point of time, as this manure will lie on the ground without answering any good purpose, till the lumps shall have been slacked by frosts; and that chalk is always most highly esteemed which yields soonest to the effect of the weather, in falling into crumbs. This manure may be laid on the ground in the summer, without any other inconvenience than what has been before-mentioned: contrary to the opinion of some people, who think that such chalk, having remained on the surface during the summer months without running, will, on that account, be less susceptible of the frosts in the succeeding winter: but this idea is erroneous; and, as it may often suit the economy of the farmer to lay his chalk out in the summer, either from a neighbouring draw-pit, having at that time little other employment for his men and horses, or, if he may be inclined to sink a pit in the field at that time; in either of these contingencies, the business may be safely ventured upon

in that season; and it would be far better to suffer the ground, which is thus summer-chalked, to lie unploughed till the succeeding spring, than to crop it with wheat at the autumn after the manure is applied; for, having enjoyed the benefit of the frosts in the following winter, the ground will come in properly for a wheat season in the next year: and this may be generally effected where a person is inclined to lay on his chalk in the summer. For instance, suppose a lay-ground be intended for a fallow the next year, this lay may be chalked in the summer-time, with very little inconvenience or injury to the farmer, as the grass which would have been produced from it between Midsummer and the following spring, could have turned to little account.

The method pursued in Hertfordshire, in chalking of land, where the workmen employed on it follow it as a business, is the following, according to Mr. Walker:—"A spot is fixed upon, nearly centrical to about six acres of land to be chalked. Here a pit, about four feet in diameter, is sunk to the chalk, if found within twenty feet from the surface; if not, the chalkers consider that they are on an earth pillar, fill up the pit, and sink in fresh places, till their labour is attended with better success. The pit, from the surface to the chalk, is kept from falling in by a sort of basket-work, made with hazel or willow-rods and brushwood, cut green, and manufactured with the small boughs and leaves remaining thereon, to make the basket-work the closer. The earth and chalk is raised from the pit by a jack-rowl on a frame, generally of very simple and rude construction. To one end of the rowl is fixed a cart-wheel, which answers the double purpose of a fly and a stop. An inch-rope, of sufficient length, is wound round the rowl; to one end of which is affixed a weight, which nearly counterbalances the empty bucket fastened to the other end. This apology for an *axis in peritrochio*, two-wheel barrows, a spade, a shovel, and a pick-axe, are all the necessary implements in trade of a company of chalkers, generally three in number. The pit-man digs the chalk and fills the basket, and his companions alternately wind it up, and wheel its contents upon the land: when the basket is wound up to the top of the pit, to stop its descent till emptied, the point of a wooden peg, of sufficient length and strength, is thrust, by the perpendicular spoke in the wheel, into a hole made in the adjoining upright or standard of the frame, to receive it. The pit is sunk from twenty to thirty feet deep, and then chambered at the bottom; that is, the pit-man digs or cuts out the chalk horizontally, in three separate directions; the horizontal apertures being of a sufficient height and width to admit of the pit-man's working in them with ease and safety. One pit will chalk six acres, laying sixty loads on an acre. If more be laid on, and to the full extent of chalking, viz. one hundred loads, then a proportionable less extent of land than six acres is chalked from one pit. Eighteen barrows-full make a load, and the usual price for chalking is 7*d.* per load, all expenses included; therefore, the expence of chalking, at sixty loads per acre, is 1*l.* 12*s.* 6*d.*; and, at an hundred ditto, 2*l.* 18*s.* 4*d.* As the chalk is considered to be better the deeper it lies, and the top chalk, particularly if it lies within three or four feet of the surface, very indifferent, and only fit for lime, or to be laid on roads, gate-ways, &c. the chalkers must be directed to lay by the chalk for the first three or four feet in depth, to be applied to the above purposes, or, if not wanted, to be thrown again into the pit when filled up; and also to pick out the flints from the chalk before it is carried on the land, for if they are not narrowly watched they will chalk with both."

It is farther stated, that "Mr. John Hill, of Coddicot, farms upwards of 1200 acres in the adjoining parishes of Coddicot and Kimpton, a considerable part of which is his own estate. He has chalked many acres of land, and approves much of the practice. He chalked a field of strong clay land in the autumn of 1793, laid on sixty loads to an acre, and the chalk where the pits were sunk lay about ten feet from the surface. He viewed the field the 7th of August, 1794; it had borne a crop of peas since it was chalked, and was then under the plough, preparatory for a crop of wheat. The chalk was good, and the land appeared to work well, though the chalk was not then thoroughly incorporated with the soil. Mr. Hill never lays on more than sixty loads of chalk on an acre: this, he finds, will not only make the land work much better with less strength of cattle, but also, with a light coat of dung, or spring dressings, occasionally laid on to quicken the vegetation, produce abundant crops for ten years; he then chalks again, with equal success."

Mr. Young advises, in his useful Calendar, that "in all works of carting, attention be paid particularly to the employment of the team; to use as few horses as possible. For this purpose, the small three-wheeled cart is, he thinks, well adapted: one horse is sufficient for two of them; one loading while the other is driving away, by means of the third wheel, which supports the weight of the cart and load, instead of the fill-horse in large carts; they do not hold more than fifteen bushels: such will do for winter-carting on grass-lands, without poaching. If the draft is not distant, three or four men will thus be employed by one horse, which is an excellence that no other machine can boast."

The above author thinks, that "July is a very proper season for the work, and should be pursued with spirit, while it admits it, on all soils. He says, on all soils, because, in winter, wet or heavy ones must not be carted in. These manures, though expensive at first, are, he observes, cheap in the end, for they last many years."

This sort of work may proceed with dispatch during most of the summer months, and also in the autumnal ones, when the soil is proper.

When land is dressed with chalk, the surface ought, Mr. Bannister says, to be pretty thickly covered over, otherwise it will fail to answer the end of pulverization, in which consists the chief virtue of this manure: and though the expense of chalking may appear considerable to those who are unacquainted with its effects,

the good consequences accruing to the future crops will be found, in the end, amply to compensate the primary charges; and from whatever cause this improvement arises, whether an immediate fertility be conveyed to the soil by the chalk, or whether this dressing acts on the soil by destroying its adhesion, and thus disposes it to work more kindly, and to part with its vegetative particles, which were before so closely united as not to be drawn forth by any other means: in whichever of these ways the chalk acts upon the land, it matters very little to the farmer, so that the intention be accomplished; namely, the acquisition of a more abundant crop. For his own part, he is inclined to think that the chief virtue of the chalk resides in its power of correcting the adhesion of stiff soils, and in its meliorating quality: and that it is much inferior to dung in point of accelerating the growth of the crop; so that, when a field has been well dressed with this manure, which is said to be of so lasting a nature as to show its good effects at the distance of twenty years, it is by no means to be understood, that this field is not to be dunged, or to have any farther addition of manure during this interval: on the contrary, such ground ought never to lose its turn of the dung-cart; and, indeed, on farms of a clayey soil, those fields only can be dunged to advantage, which have been previously chalked; for experience hath demonstrated, that, without the application of this manure, dung will be but of small avail on these stiff soils.

On gravelly soils, where the springs lie within a small distance of the surface, it often happens that the water flows in before the chalk is found, and thus all further endeavours at that spot are rendered abortive, and another pit must be sunk in a different part of the field. Obstacles to this work sometimes fall out from the light contexture of the soil, which does not unfrequently give way, to the destruction of the chalk-drawer. To the farmer, it may be of some consequence to consider the nature of his land, ere he embarks in this scheme of husbandry; as, if from the circumstances above-mentioned, he may have reason to think that his pit will not stand firm, it would be a matter of prudence to desist from any further thoughts of sinking a perpendicular pit, and change the mode of operation by bringing his chalk from an uncallowed pit; but where it can be obtained at a moderate expense, and with a tolerable certainty of success, the preceding method is certainly the most eligible. See *Calcareous Earth.*

CHALKY *Lands*, are such lands as are impregnated with chalk, and which, from their white appearance, are sometimes provincially called *white lands.*

It is observed, by the author of the Synopsis of Husbandry, that "chalky soils differ from each other very essentially in point of fertility: for as there are some of them which, by good husbandry, may be brought to produce large crops, and do, with great reason, take the lead, in point of fertility, of every other light soil, so there are others, which, from the superficial depth of mould over the chalk, are of the most barren species, and scarcely worth the expense of tillage. A chalky soil, says he, with a due covering of mould, so as to admit the plough to enter at a reasonable depth, is, perhaps, the most kindly one to work upon, except a loam, and capable of the greatest improvement from the several operations of husbandry; having neither the tenaciousness of the clay, the burning quality of the gravel, nor the extreme porous texture of the sand: as it possesses a much greater share of humidity than the two latter soils, free from the inconvenience of springs, so will it be less injured by a dry summer; whilst a moist and dripping season will be most favourable to the crops growing on it, when those on a clayey soil are, in that case, too frequently destroyed, or rendered of little worth." And Lord Dundonald, in his Treatise on the Connection of Agriculture with Chemistry, remarks, that a pure unmixed chalky soil, like a pure or lean clayey one, is unfertile; and that the fertility of this sort of soil, like all others, depends on its containing a due admixture of other earths, with the requisite quantity of vegetable or animal matter. A chalky loam, or mixture of chalk with clay, is frequently a very fertile soil, and well adapted to the culture of beans and wheat.

Such, says the writer we have first quoted, are "the advantages attending these soils, where the chalk is not mixed in an undue proportion with the mould; but it rarely happens that a farmer is possessed of any great quantity of land of this description; for, in countries where the chalky soil abounds, there is on every farm a larger proportion of poor land, than of that which he has described; and the management of these thin chalks will demand the highest exertion of industry and skill in the husbandman; for although the crops raised on these soils are less subject to be injured by the scorching heat of the sun than those on gravels, yet where there is but a small proportion of mould, so that the chalk forms the greatest part of the cultivated soil, with a bed of the same hard substance for its under-stratum, intermixed with large flints and chalk stones, scarce less solid; on such grounds, the crops suffer greatly in a dry summer, and, for this reason, an early Lent season is always to be preferred on these soils, in order that the surface of the ground may be covered before the dry weather sets in. These chalky soils possess another very material advantage over gravels, namely, the power of resisting longer the heat of the summer; and, therefore, the crops on this soil often recover after a kindly rain, when those on the gravels, unable to withstand the preceding drought, are burnt up: indeed, on a chalky soil, the crops, when injured by the parching heat of the weather, cannot so properly be said to burn, as to die away. To the evil propensities incident to chalks of every kind, may, he says, be subjoined their disposition to blast—a misfortune not easily to be guarded against; and, in this respect, they differ materially from gravels, where the corn generally yields well, if not injured by the dry weather during its

growth. To this may be added, another defect attached to chalky soils, which is their hilly situation; since, in a tract of land of 200 acres, it is odds but many of the fields are mountainous and uneven." The ingenious nobleman just mentioned further remarks, that chalky soils produce a short sweet herbage, and, for the most part, are more proper for sheep-pasture than for tillage. There are no soils that receive more benefit from artificial watering, as they are apt, at certain seasons, to be parched by drought. Chalky soils, that produce short sweet herbage, should not, he thinks, in general, be broken up, or converted into arable lands; a practice which will be attended with injury to the soil, and loss to the farmer, unless they are cropped with moderation, well manured, and afterwards properly laid down with pasture-grasses.

And Mr. Bannister observes, that there is one species of grass which may be raised to great advantage on a chalk, and this is saintfoin, cinquefoil, or holy grass. The small expense required in the culture of this grass, its natural relation to a chalky soil, the constant demand for the hay at market, and the small charges required in the making it, says he, all combine to enforce its cultivation on the most barren chalks; which, by any other course of husbandry, could not have been brought to pay the expense of tillage: by these means the farmer will have it in his power to bestow a greater attention on the more fertile part of his land, will require a less number of horses and servants, and will generally insure to himself plentiful crops of grain, from that part of the farm which is kept in constant tillage; whilst the most barren spots will produce a yearly increase from the saintfoin, at a trifling expense in the culture.

Chalks are, he thinks, of all other lands, least subject to be molested with couch-grass; and hence a person who hath not been accustomed to this kind of land, is often deceived on a cursory view of the surface, which being totally free from couch-grass, and not greatly infested with weeds of any denomination, he is led to conceive that the ground is in good heart, and disposed for the reception of any kind of grain: whereas the contrary is often the fact; for a soil of this description, especially the more barren species, which, with a very slight proportion of earth, is made up of a crumbly kind of chalk, and, when wet, wears the appearance of mortar, will not naturally produce couch; and, perhaps, on this sort of ground, it would be no easy task to make this grass thrive in it, though the experiment were attempted; and even on the best and most kindly chalks, couch-grass is an enemy not to be dreaded. The weeds which seem indigenous to this soil, are poppy, bare-bind, crowfoot, charlock, cadlock or kilk, cammock, and thistles. Where the last-mentioned weed prevails, it is a manifest indication that the ground is not of itself unkindly to the growth of corn; and that when the crops turn out defective, this proceeds less from any defect in the soil, than an improvident management in the cultivation.

In regard to the tillage on this sort of land, though chalk may be numbered among the lighter kinds of soil, a much greater strength of horses, he says, is required in the tilling of them, than either on gravels or sands; not only on account of their hilly situation, the superior depth of mould, and of the large flints which are generally to be met with beneath the surface, but from the impenetrable quality of the under stratum, which deadens the draft of the plough, and causes it to work much heavier; to which may be added, the resistance from the roots of the cammock, which is so powerful as frequently to obstruct the course of the plough. For these reasons, a six-horse team on a chalky soil is of great utility, nor indeed can the business be advantageously prosecuted with four horses to a plough. Another reason why a more powerful strength of cattle is requisite on this than on any other light soil, is its disposition to hang to the gears; so that in wet weather the plough is increased to nearly double its own weight, by the additional load of mould adhering to it. These are circumstances which do not immediately strike the attention of a farmer whose knowledge in husbandry has been acquired by working on a kindly loam. On the first view of a chalky soil, he concludes that little strength of cattle is required; for, having been accustomed to land where the staple is much deeper, he rationally infers, that more work may be done in a given distance of time with a less number of horses on a chalk than on a loam: of this truth he is in his own mind so thoroughly convinced, that nothing less than ocular demonstration can drive him from his opinion.

Having enforced the necessity of maintaining a sufficient strength of cattle for the tillage of this sort of soil; he advises the ploughing it to a good depth, where the staple of the land will admit of the practice; for on the very light chalky grounds which abound in many places, and of which some parts of every chalky farm consist, this caution is unnecessary: such land being ploughed with little strength, the plough must necessarily be set to go shallow. But on his other grounds, where there is a thick covering of mould, the farmer, he thinks, will always find his account in ploughing it to its utmost depth, so that the ploughman may feel the point of the share grate on the chalk beneath, without bringing up any part of it to mix with the mould. On this soil, the blacksmith is, he observes, a perpetual retainer to the farm. The vicinity of the chalk, together with the number of large flints usually met with on this kind of ground, operating very forcibly in his favour, the eye of the farmer is, therefore, on no occasion more necessary, than in a strict and daily examination of the plough irons, since he may be materially injured either by a too frequent application to the smith, or too great a neglect of him. The point of the share for ploughing chalks to advantage, especially when infested with thistles or cammocks, ought to be hammered to the breadth of four inches, which will tear the roots up at a considerable depth. As these grounds are seldom injured by wet, there is scarcely any part of the year but the plough may be

kept at work, save only when the land is locked up by frost, or the surface covered with snow. The breaking up of clover-lays in the summer, in order to sow with wheat in the autumn, is often attended with great inconveniences on chalky soils, as the drought of the season frequently causes the ground to be so extremely hard, as to render the operation of the plough a matter of great difficulty, and, in some instances, the soil is totally impervious at this season, and must remain to be softened by the autumnal rains. But, in this case, the farmer has generally other work to attend, and therefore need not suffer his men and horses to lie unemployed. But although for these reasons there is generally more perseverance required in breaking up a clover-lay at Midsummer to sow at Michaelmas with wheat, than usually falls to the share of a common ploughman, yet the master ought not to be discouraged, since he will most assuredly reap the good effects of corn sown on a stale furrow where the land is chalky, and indeed on any other soil of a light texture.

Where folding is practised, a very judicious method at the breaking up a clover-lay is to plough one day's work, which will employ a fold of 300 sheep eight nights; and when that is finished, to plough another day's work and fold on the same, which course is to be pursued till towards autumn: by this mode, the farmer reserves great part of the feed on the lay, which, though not very considerable, is nevertheless of some consequence where a large flock is maintained; and, in truth, without a flock of sheep, little profit can be expected to accrue from the cultivation of these soils: besides which, he avoids the ill effects of ploughing up the whole field at autumn, and sowing it immediately with wheat, as he supposes, in this case, the greatest part of the field will have been folded on before seed-time, and the remainder may be finished after the corn is sown, or trodden with sheep—both of them instances of excellent husbandry. But though there be no folding flock kept on the farm, this method of ploughing up the clover-lays at Midsummer ought to be pursued for the reason above-mentioned; and at this time the farmer is generally at leisure to prosecute this work, having completed his saintfoin harvest and turnip-season, and not meeting with any hindrance from the stirring of summer fallows—a piece of husbandry which is rarely practised on these soils.

The like method of ploughing should, he says, be pursued, in order to obtain a crop of turnips on a chalky soil, as is recommended on a gravel; and though the land be of a very light texture, and not much infested with weeds, the several operations of the plough, harrow and roll, ought by no means to be dispensed with, for the reason which is offered in treating of the tillage required on a gravelly soil. On a chalky soil properly managed for turnips, and where a good crop of this root has been fed off, there need be no fear of a plentiful return of barley or oats, provided such corn be sown at an early period, which is particularly to be attended to at the spring season, as the crops of Lent corn on these soils will generally fail, if the seed-time be protracted so late as is usual on loams.

On this kind of land, as on gravels, says he, the farmer possesses the advantage of varying his manure as often as he chooses; having, besides yard-dung, which may be styled a general dressing for every soil, the whole tribe of manures, except chalk, to select from. For wheat, there is no application so efficacious as the fold, which, when properly conducted, rarely fails of increasing the crop. For turnip ground, dung, mould, rabbit dung, woollen rags, &c. may be laid on to advantage; and to further the growth of clover, saintfoin and meadow-grass, coal-ashes, soot, and malt dust, are very proper applications: of these, the two last, if sown over the green wheat in the spring, or harrowed in with the barley at the time of sowing that grain, are excellent substitutes for the more lasting kind of manures, where these cannot be procured in sufficient abundance.

It is remarked by lord Dundonald, that clay is the fittest substance to be applied with a view to alter the arrangement of the parts of a chalky soil. Peat is a good application to soils of this nature, which are frequently termed hungry soils, and very deficient in vegetable matter. And as a sufficiency of dung is not to be procured to manure fully every part of a farm, peat may be applied in one or other of the states of preparation mentioned under that head. See *Peat*. Unfortunately for the improvement of chalky soils, says he, neither clay nor peat is to be found but at the extremities or outskirts of the extensive tracts of chalky countries; but whereever they are to be had, the application of them should not be neglected. Calcareous or chalky soils, which have long been under the plough, contain a large proportion of phosphat or oxalat of lime. These insoluble saline matters may, he says, be rendered serviceable to vegetation by alkalis, vitriolic acid, vitriolic neutral salts (especially if superacidulated), and by pyritous and aluminous substances. Even green vitriol, which has hitherto been considered as unfriendly to vegetation, will, when applied in a proper manner to soils like this, considerably improve and promote the growth of pasture-grasses. More experiments are however wanting fully to ascertain the utility of these chemical substances.

The principal disadvantage, says he, attending chalky soils, is that of their being too dry and parched at certain seasons; but possibly this defect, when they are under pasture, may be counterbalanced by the more early grass they produce in the spring, as well as the luxuriant herbage that succeeds the autumnal rains.

The best produce of the grain kind, in chalky lands, is barley and wheat; but oats will likewise do well on them. Their natural produce for weeds is poppies, May-weed, &c. For grass-seed, saintfoin, trefoil, and, if rich, clover. The best manure for these lands is rags, dung, folding of sheep, &c. In these lands, if rain happen to fall on them just after sowing, before the corn gets up, it will frequently cause the earth to bind so hard, that it

cannot get through it; but may be much helped by a light harrowing, and other means of a similar nature. In breaking up lands of this nature from grass, too great a depth of furrow should, in most cases, be avoided.

Under the class of chalky lands, a very large proportion of the grounds of this country may be comprehended.

In Hertfordshire they manage these lands for grain in the same manner as they do their clay-lands; but in Oxfordshire they commonly manure them with half-rotten dung, which, they say, prevents the binding of it; and some mix it with sand, which causes it to work short, especially if in any degree dry. They commonly sow them with wheat, mislen, and barley; and after wheat, peas, or vetches: in doing of which they are obliged particularly to take care to have fine weather, because of the land's binding. See *Soil*.

Chalky-*Soil*, that sort of soil in which chalk forms a principal ingredient. See *Soil*.

CHALYBEATES, a term applied to a class of remedies whose tonic properties depend on the quantity of steel or iron contained in them. This sort of remedy is often made use of in farriery.

CHANFRIN, in *horsemanship*, the fore-part of a horse's head, from one hand to the other.

CHANGE *of Crops*, that part of husbandry which relates to the changing and cultivating different sorts of crops, on any kind of soil, in order to prevent its being exhausted.

Experience soon taught men, that even the most fruitful soil cannot constantly yield the same grain; and this of course laid them under a necessity of seeking for means to remedy the defect. They found the plough the most ready, and perhaps the most effectual: and hence all the ancient writers so highly commend a thorough ploughing. At the same time the apparent loss of the produce of the ground, during the year of fallow, put them upon inquiring how this inconvenience might be prevented, consistently with keeping the land in good heart. Repeated observations convinced the Romans, the most attentive of all nations to every thing relative to husbandry, that, besides the alternate resting of the land, wheat might, as is observed by Pliny, be sown after lupines, vetches, beans, or any other plant which has the quality of fertilizing and enriching the soil. A judicious change of crops is, therefore, without doubt, of great importance in the common tillage husbandry, as it enables the farmer to save the expense and loss of a crop in the fallow year; and to get quit of weeds, by attacking them at different seasons in the year, and in different periods of their growth; both from the nature of the crops cultivated, and where the intermediate crops are hoed, as those of beans, peas, and many others.

In the change of crops that are cultivated for the purpose of preventing the exhaustion of land, by the repeated sowing of the same kinds of grain, attention should always be had to the nature of the soil, and the intentions of the cultivator, as it is only in this way that the most advantageous changes can be adopted in the different situations and conditions of land.

The changing of crops, though a practice of infinite consequence in agriculture, and which was much attended to at an early period of the art, seems to have been much neglected afterwards, until lately, when the culture of turnips probably furnished the useful hint, and led the farmer to observe, that his land, instead of being impoverished by that root, was enriched, and prepared to yield a better crop of barley in the spring. This might likewise suggest to him, that other succulent plants, which cover the earth with their leaves, might have the same effect; and the success which has followed has answered his utmost expectation, as it is now found that a fallow does not become necessary in several years; the ground being kept in heart by a variety of crops, when rightly timed and properly managed.

It has been found that some crops, as peas, beans, clover, and all plants of the pulse kind, are enrichers and cleaners of the earth; while wheat, oats, barley, and the whole tribe of vegetables, whose roots are fibrous and spread far, impoverish and rob the ground. The latter also let it become foul, by giving way to weeds and grass, which, being the natural products of every soil, are more readily nourished by it than such plants as it does not spontaneously produce. It is therefore evident, that by judiciously interposing such green or other enriching crops as are adapted to the soil between the grain-crops, the farmer may not only, in a great measure, avoid the necessity and expense of fallowing, but frequently be enabled to reap better crops. Besides, under this system of management, he may be enabled to keep a much larger stock of cattle, and consequently produce a much larger quantity of manure, the advantages of which are very great. See *Green Crops*, and *Rotation of Crops*.

Change *of Seed*, the practice of sowing seed taken from a different soil, in order to prevent the land from becoming tired with the same kind of grain.

This is a custom pretty common among farmers, though experience has not yet shown how far it is well founded. It is observed by Mr. Middleton, in the Agricultural Report of Middlesex, that the changing of the seed of corn every two or three years, though extremely general, is done at an extra expense of from sixpence to one shilling a bushel on wheat, and half those sums on other kinds of grain. This practice is, he thinks, as little founded on propriety, as a change of live-stock once in every two years would be, and never will be the means of advancing corn to a high pitch of excellence. On the contrary, when corn-farmers become wise enough to apply Bakewell's method of improving cattle to the raising of seed grain, the advance will be rapid indeed, and its improvement will go on towards the mark of perfection, in a degree which, in the present state of things, can scarcely be conceived. The method he wishes to recommend to those cultivators who desire to excel in the article of grain, is, he says, the following: namely, a few days before harvest, to walk through their fields of corn, to select and

gather the prime samples of every species of seed, and ever afterwards to continue the same practice, by repeating the operation of collecting the most perfect grain from the crops produced from such selected seed. The same observations, he asserts, apply to every variety of cultivated crop.

However this may be, we are inclined to believe, from observing what takes place in respect to the curl, a disease in potatoe-crops, that a change of seed may sometimes be useful, though, perhaps, much less frequently than is the practice of farmers in general. See *Seed* and *Sowing*.

CHANNEL, in *farriery*, is used for the concavity in the middle of the lower jaw of a horse, where the tongue lies. This hollow being bounded on each side by the bars, terminates in the grinders, or maxillary teeth. It is in this hollow that the barbles grow.

Channel-*Bone*, a term applied by some veterinary writers to the collar-bone in horses.

CHAPELET, in *horsemanship*, a couple of stirrup-leathers, mounted each with a stirrup, and joining at top in a sort of leather buckle, called the head of the chapelet, by which they are made fast to the pommel of the saddle, after being adjusted to the rider's length and bore. They are used equally to avoid the trouble of taking up or letting down every time a person mounts on a different horse and saddle; and to supply the place of academy saddles, which have no stirrups.

CHAPERON *of a Bit-Mouth*, in *horsemanship*, is used only for scatch-mouths, and such others as are not cannon-mouths, signifying the end of the bit that joins to the branch just by the banquet. In scatch-mouths, the chaperon is round, but in others it is oval; and the same part that in scatch and other mouths is called chaperon, is in cannon-mouths called *froncean*.

CHARBON, in *horsemanship*, signifies that little black spot, or mark, that remains after the large spot in the cavity of the corner tooth of a horse is gone. About the seventh or eighth year, when the cavity fills, the tooth being smooth and equal, it likewise disappears.

CHARCOAL, a material consisting of wood charred, or half-burnt. See *Carbon*.

In the Rural Economy of the Midland Counties, Mr. Marshall says, that in making charcoal, men accustomed to the business cut and cord the wood in the winter, and burn during the summer season. The minutiæ of the process are these: The site or hearth being determined upon, the turf is pared off, and the sods laid on one side. The wood, about ten cord, is then laid in a ring, somewhat wider than the intended hearth; beginning on the outer circumference of the ring, with the smallest of the round wood, laying the larger pieces of top-wood, and the cloven roots or but-ends, towards the centre. With these last, some of them nearly as large as bushel-blocks, they begin to make their pile, leaving a kind of chimney in the middle (a vertical aperture from a foot to eighteen inches wide), and round this core of roots set up the topwood (which has previously been cut at the time of cording, in such a manner that no forkedness nor other awkward crookednesses are left; or, if not cut in this manner, or cut improperly, it is prepared by the colliers themselves, previous to laying it ready for setting), joining the blocks, or rather fitting them in, as close to each other as possible; placing the convex side of the logs outward, forming the pile in the shape of an inverted bowl, nearly semiglobular. The pile being formed, it is covered over with sods, which are pointed, to keep in the heat the better, and the seams are filled up with fine pulverized mould. The chimney is now filled with short pieces of dry wood; near the top a live coal is put; over this one layer more of dry pieces; and upon these a close cap of sod is placed: nevertheless, this one coal, not larger than the fist, and excluded from the open air, is sufficient to set the whole pile on fire. As the pieces in the chimney burn away, they are replaced by fresh ones: thus feeding the fire with fresh fuel. Paled hurdles are placed on the windward side of the heap, to prevent the fire from acting partially.

When the fire begins to work itself out, at the outward skirts of the bottom of the pile, it is known that the coal is fully burnt (or rather the wood sufficiently charred), which it will be, in a pile of ten cord, in fine dry weather, in seven or eight days. The fire, during the whole time, is carefully kept from breaking out, by throwing mould or ashes upon the weak parts: so that, though the fire passes through every part of the wood, little or none of the matter of heat escapes.

It is observeable, that notwithstanding the intense heat, no part seems to be consumed; not the bark only, but even the moss upon it, comes out as entire as when it went in; the only apparent change is in its being rendered friable and of a black colour. Wood that is charred seems to be only very highly dried.

It shrinks considerably during the process of charring; but there is no visible derangement of parts. One of the smaller pieces, which is not broken in the drawing, appears as entire when it comes out as when it went into the pile. The brittleness after charring, however, shows that the texture of the wood is altered by the action of the fire. As soon as the fire is out of the coal, on the outside of the heap, the workmen begin to draw; which is done by running a peel between the coal and the hearth, raising up the coal in such a manner as to let the mould and ashes of the sods fall through between the pieces, upon the inward parts still full of fire. If this makes its appearance in any particular spot, a peel-full of ashes is immediately thrown against it. Having got sufficiently near to the fire, the coals raised by the peel are raked off with long, wide-toothed, iron rakes; the teeth about a foot long, and standing about six inches apart; the handle and head of wood, except a plate of iron on the back, with which the small coal is gathered together. No sieve, nor any rake with finer teeth than the above, is used. The coal being light, it is readily brought to the surface of the ashes and dirt; and, when there, is easily collected with the back of the rake. The side, thus

drawn, being rounded up and secured with ashes, another, the coolest part, is drawn in the same manner. The drawing is an infernal business; the men work among fire and heat enough to suffocate Satan himself. Such pieces as still retain fire, after they are drawn, are quenched with water; which the workmen have plenty standing by them, in pails. If a large piece contain much fire (which hides itself chiefly in the chinks of the large pieces), it is plunged bodily into the water. If the heap itself prove too refractory to be kept under by the ashes alone, a sufficient quantity of water is thrown upon it to keep the fire under. Such large pieces as are suspicious are laid on one side; in order that those which take fire may be the more readily discovered. A waggon attends to take away the coal as fast as it is drawn. For, if it take fire, or get wet, in the hands of the burners, it is at their risk: and while in the waggon, it is at the risk of the waggoner. Every particle burnt is so much entire waste.

The quantity of ashes arising from a charcoal hearth, he says, is considerable. There were four cart-loads taken up from two small hearths, and a load or two more still remained.

The dust of charcoal has been found, by repeated experience, to be of great benefit to land, especially to such as is stiff and sour. It is to be used in the same manner as soot and wood-ashes. See *Ashes* and *Soot*.

And the author quoted above observes, that charcoal ashes are in good esteem in the midland districts as a manure; particularly for turnips, and for fining grass-land. They arise principally from the sods used in covering, but, in part, from the bits of coal which break off in raking it out of the ashes.

CHARGE, in *farriery*, a preparation of a middle nature between an ointment and a plaster, or between a plaster and a cataplasm; or participating of all three, being partly made up of oils, meals, pulps, and partly of gummy and resinous things, that give a stiffness and body to plasters.

Charges are of different kinds, like all other forms of outward application; some being emolient, others discutient, and some altogether repellent; of which kind are most of those called cold charges, some of which are styled defensive or strengthening. They are made use of in various intentions; such as lessening inflammatory and other tumors, and removing old sprains, &c.

The following shows the nature of their composition:

Take of mastic, dragon's blood, myrrh, gum tragacanth, of each one ounce; common pitch, six ounces; bole armeniac, litharge in fine powder, of each two ounces.

Boil all the ingredients in a sufficient quantity of vinegar over a slow fire, until they grow ropy; then take them off, and add the bole in fine powder so as to make a charge.

It is used in strains, and to abate the heat and inflammation attending large wounds, being applied over the dressings. Likewise in inflammation of the eyes, being laid all over the head, temples, &c.

CHARLOCK is a weed too generally known to need a particular description. It is frequently called *Chadlock*, *Catlock*, *Corlock*, and *White Rape*. Almost the whole plant is covered with bent pellucid hairs. It is a very troublesome weed in arable land. See *Weeds*.

There are two sorts of charlock, one bearing white, and the other yellow flowers; but they seem to be only a variety of the same plant. The young plants of charlock so nearly resemble those of turnips, that they are not easily distinguished but by the taste; the charlock being hot and bitter, and the turnip mild. Farmers should therefore be very careful in weeding their turnips, lest they mistake them for charlock. It is observed by Mr. Lisle, that cold wet lands are always more subject to charlcok than white or chalky lands; and that, by an experiment which he made in sowing charlock-seed and turnip-seed at the same time, he found that the turnips appeared in three days, but the charlock not in less than ten.

It has been remarked, that sheep are fond of eating these weeds.

CHARRING *of Posts*, the practice of reducing that part of the surface of posts which is to be put into the ground to the state of charcoal. This method of preparing posts is highly useful where they are to be placed in wet situations, or to stand between wet and dry. The practice is common in Norfolk; where, according to Mr. Marshall, it is thus performed:—A trench is dug eighteen inches wide, eighteen inches deep, and six feet long; and aired by burning some straw and a faggot or two in it, previously to laying down the posts. This being done, three posts are laid across the trench; placing the part to be burnt, namely, the part proposed to stand between air and moisture, immediately over the fire; thrusting the fuel (dry small oven faggots) in at the windward end of the trench. As one side becomes charred, another is turned downward; and, to prevent the fire from spreading too wide (reaching too high up the post), the part not intended to be burnt is wetted by means of a wet straw-band, tied round the post, in the part where the fire ought to be checked; pouring water from time to time upon the twisted straw. The posts having been repeatedly turned on all sides, until white ashes begin to form on the surface of a black coat of coal, about one-tenth of an inch thick, they are removed, and their place supplied by others. Chips, he says, are preferable to faggots, as fuel, in this operation; as they can be dropt in between the posts wherever an increase of fire is wanted.

It has been suggested, that great advantage may be derived from this practice, in the preparing the bottoms of hop-poles.

CHASE, a term sometimes used to signify a row or rank. Thus, in the planting of quick-sets, a single chase implies a single row; a double chase means, provincially, a row planted below the first, not immediately underneath the upper plants, but under the middle of the intermediate spaces.

CHASE, a term likewise applied to an extent or

space of a sort of forest-ground, used as a range or station for different sorts of wild beasts; but which differs from that of forest, as being capable of being in possession of a subject, which that cannot in propriety be; in not being so extensive, and in not being endowed with so many liberties, as courts of *attachment*, *swainmote*, *justice-seat of eyre*, &c. It also, on the contrary, differs from a park in being of a larger compass, in having inclosed within it a great variety of game, and in being under the management and direction of a greater number of overseers and keepers.

Chase-*Land*, that sort of ground that was formerly in the state of chase.

Chase, in *horsemanship*, a term sometimes made use of in breaking-in horses for hunting. And some advise that young horses, that are intended for stag or fox-hunting, should be trained and accustomed at first to that sort of exercise; while others suppose that such chases are too severe for young horses, and advise their being trained after harriers, which is probably in general the most proper. It is sometimes written *Chace*.

CHATS, a term employed in some districts to signify the keys of the ash, sycamore, &c.

CHAVLE, a provincial word, used to signify chewing imperfectly.

CHEDDER-*Cheese*, a large kind of cheeses, which are so named from their being made at Chedder, a village near Mendip-hills in Somersetshire, famous for its pastures. It is common in this place for three or four dairies to join their milk to make one great cheese, which generally weighs from one hundred and fifty to two hundred weight; and which they often sell at a very high price.

CHEESE, a well-known kind of food, prepared from milk by coagulation, and separated from the serum, or whey, by means of pressure, after which it is dried for use.

In the making of cheese, there are several circumstances that deserve the attention of the farmer: such as the season and the method of milking; the nature of the milk; the mode of colouring; the preparation of the rennet; the breaking and gathering the curd; the management of the cheese in the cheese-press; the method of salting; and the management in the cheese-room.

It is observed by Mr. Donaldson, that the best season for making cheese is during those months when the cows can be fed on the pastures; that is, from the beginning of May till towards the end of September, or, in favourable seasons, the middle of October. On many of the larger dairy-farms, in several districts, cheese is, he says, frequently made throughout the year; but that made during the winter months is considerably inferior in quality, and much longer of becoming fit for sale, or for use, than that which is made within the periods which have been just mentioned. In Gloucestershire, Mr. Marshall says, the season of making thin cheese is from April to November; but the principal one for making thick, is during the months of May, June, and the beginning of July. If made late in the summer, they do not acquire a sufficient degree of firmness to be marketable the ensuing spring.

In the times of *milking*, there is considerable difference in different districts; in Cheshire, they are, according to the author first mentioned, during the summer season, six o'clock both morning and evening, and in winter at day-light in the morning, and immediately before dark in the evening. But in other districts, as Wilts, Suffolk, &c. he says, the people are frequently employed in milking by four o'clock in the morning in summer, and the business in a dairy of forty or fifty cows is nearly completed before the usual period at which it commences in Cheshire. This last, says he, is certainly the preferable practice, as, when the cows are brought home to the fold, or farm-yard, which always happens where the pastures are within a reasonable distance, and milked unfettered, which is also commonly the case, the milking ought to be over before the heat increase so much as to make the cows restless and unruly. A man, either the farmer himself, or some careful person, should attend the milking of the cows, for the double purpose of superintending the due performance of the work, and of carrying the milk in large buckets, into which it has been occasionally emptied from the milking-pails, from the fold to the dairy, where it is poured through a search into the cheese-tub, preparatory to applying the rennet. In all well-managed dairies, particular attention should be paid to the thoroughly milking of the cows; as when this is omitted the cows are apt to go dry. Besides, it is well known that the last of a milking is very greatly superior in quality to that which is first drawn.

In respect to the milk, it is obvious that on the quality of it must depend, with ordinary management, the goodness of the cheese. The quantity of cream that is used is different, according as they are one-meal or two-meal cheeses.

If none of the cream of the preceding night's milk be abstracted, but made to incorporate with the milk of both milkings, it does not seem to Mr. Donaldson, that the quality of the cheese made from the milk of last night, and that of this morning, mixed together, can be in any material degree debased.—But, says he, not only in the dairies in Cheshire, but in every dairy where two-meal cheeses are made, a certain portion of the cream is withheld.

He also observes that, in regard to the degree of temperature which milk ought to possess, so as to be in the best possible condition for applying the rennet, all his dark and uncertain. In this branch of the business, general rules are not attended to, nor can they become in any material degree useful, as a guide to direct the conduct of an inexperienced cheese-maker, as the practice of almost every particular dairy differs from that of another. That which is adopted in Cheshire, although extremely indefinite, seems as a general rule worthy of consideration, namely, that the lowest degree of heat which milk ought to possess, when the rennet is applied, is one-half of that of milk from the cow;

the highest, about twice the natural warmth. From this it may be inferred, says he, that by the time a large dairy of cows can be milked, and the milk put together for the purpose of artificial coagulation, the dairy-maid will not err materially by applying the rennet immediately afterwards. This rule is however very uncertain, and liable to exception, on account of the variation in the seasons, and the frequent and great changes that take place in the state of the weather in the same season. Accordingly, in all dairies remarkable for cheese of a superior quality, the heat of the milk, before the rennet is applied, is raised or lowered, by the addition of warm milk or of cold water, to that degree which, in the practice of the particular dairy, is found from experience the most eligible. It is surprising, continues he, that in large dairies the use of the thermometer is not as well known as that of the skimming-dish—as to ascertain with precision, by a course of well-conducted experiments, the temperature most proper for milk to possess at the time the rennet is applied, could not fail to be greatly in favour of the quality of the cheese, and would in all probability tend to prevent the cracking, blistering, and hoving, which so frequently take place in cheese, in consequence of some mismanagement in the making. An instrument has, however, been lately invented, which, if found on experience to answer, must have the effect of throwing a great deal of light on the whole system of dairy-husbandry, and must be the means, in time, of reducing the business of butter and cheese-making, which is at present carried on without any established rules by which the operator can be guided, to something like fixed invariable principles. See *Lactometer*.

By the use of this instrument, together with the thermometer, and by discovering a mean whereby to ascertain the strength and quality of the rennet, and the proportion which is necessary to be used for coagulating a given quantity of milk, he thinks, the management of a dairy where cheese is made would be greatly improved.

As the *colouring* of cheese has been so long common in the cheese districts, it is probable that cheese of the best quality would be in a great measure unsaleable, if it did not possess the requisite colour. The degree of colour is regulated chiefly by the name under which it is intended the cheese should be sold, as Gloucester, Cheshire, &c. The introduction of this practice was no doubt a species of fraud, as it was intended to convey an idea of richness which the cheese did not really possess. This is the more evident, he thinks, as it is universally allowed, that the leanest cheese always requires the greatest quantity of dye to bring it to the proper degree of colour. The colouring of cheese is, however, now so common, tha an intention of fraud cannot, with propriety, be ascribed to those who adopt the practice. The material which is employed for this purpose is Spanish arnetta. (See *Arnetta.*) The weight of a guinea and a half of it is considered in Cheshire sufficient for a cheese of 60lb.; and in Gloucestershire, an ounce is the common allowance to the hundred weight.—There are different ways, Mr. Donaldson says, of preparing the arnetta, as well as of applying it. The method used in Cheshire is, when the dye is wanted in the morning, to tie up the necessary quantity of pounded arnetta in a linen rag, and to put it into about half a pint of hot water in the evening. In the morning, immediately before applying the rennet, the infusion of arnetta is poured into the milk, and the mixture is then well stirred about, so as to make the milk and the dye incorporate intimately together. In other districts, it is common to rub a piece of unpounded arnetta, after having been previously dipped in milk, on a smooth stone, in the same manner that paint is ground. The colouring thus obtained is mixed with the milk in the cheese-tub, in the manner and at the period before mentioned, care being taken to prevent any of the unreduced particles of arnetta from falling into it.

In regard to the *rennet*, it may be observed, that milk may be coagulated, or turned into a curdled state, by the application of any sort of acid; but that substance which is most commonly used is, the maws or stomachs of young calves prepared for the purpose. These are most generally denominated *rennets*: but they are also often provincially called *vells*, and in Scotland *yearnings*. When the maws, which usually contain a curdled kind of substance, are purchased from the butcher, they are opened, and the curd of thick substance taken out: this having been repeatedly washed in cold water, as well as the bag which contained it, it is again replaced, with a considerable addition of salt, and then packed in a jar, into which is poured a very strong brine of salt and water. In many instances, the maws are allowed to remain in this state for about twelve months before using; in others, after having remained some time covered with the brine, they are taken out, and an additional quantity of salt being applied, they are hung up in the dairy, or some other convenient place, to dry, and remain in that state till wanted for use. The using of small pieces of *vell*, that have been previously pickled and dried in the manner last mentioned, as a coagulum, after infusing them over night in a little warm water, although a common practice even in Cheshire, appears so evidently improper, that it is surprising, the same author says, it should be any where continued. The methods of curing, when each *vell* is cured separately, and the coagulating powers which one may possess beyond another, are so different, that, when an inch or two of a particular *vell* is depended upon for effecting the purpose, the dairy-maid must remain constantly in a state of suspense, nor is it possible that with all her attention the proper quantity can be in common applied.—Whether the *vells* necessary for a season are kept in brine, or pickled and afterwards dried, the best method of preparing the rennet for use, because attended with the greatest degree of certainty in regard to its being of equal strength and quality, is to extract the substance from the whole at once. This is frequently done in Cheshire; but he believes no where else in Great Britain; the only way in the other cheese districts being to use rennet extracted

from one or two *vells* only. The best mode of preparing rennet adopted in Cheshire, is to put the *vells* into an open vessel, and to pour in two or three pints of spring-water for each, according to the number. In this state they are allowed to stand about twenty-four hours. The *vells* are then taken out, and put into other vessels, with about half the quantity of water. They are then allowed to remain for a like period, when being taken out and thrown aside, as no longer of use, and the first and second infusion being mixed together, and strained through a sieve into a jar or other vessel, a considerable quantity of salt is added. This liquor is then fit for use, and requires no after-management beyond that of taking off the scum that usually rises to the top, and of adding a little salt when that already in the jar is nearly dissolved. About half a pint of this preparation, wine measure, is sufficient for coagulating such a quantity of milk as will make sixty pounds of cheese.

It is observed by the author of the Rural Economy of Norfolk, that there the curd which happens to be contained in the stomach of the calf when butchered, together with the hairs and dirt which are inseparable from it, are used by the dairy-women to coagulate their milk: hence, probably, the rancid flavor of the Norfolk cheese; perfectly resembling in scent the parent curd; and this, as nearly as may be, its more matured self.

The rennet which he made use of in his different trials was prepared in the following manner:—Take a calf's bag, maw, or stomach; and, having taken out the curd contained therein, wash it clean, and salt it thoroughly, inside and out, leaving a white coat of salt over every part of it. Put it into an earthen jar, or other vessel, and let it stand three or four days; in which time it will have formed the salt and its own natural juices into a pickle. Take it out of the jar, and hang it up for two or three days to let the pickle drain from it; re-salt it; place it again in a jar; cover it tight down with a paper pierced with a large pin; and in this state let it remain until it be wanted for use. In this state it ought to be kept twelve months: it may however, in case of necessity, be used a few days after it has received the second salting; but it will not be so strong as if kept a longer time. In order to prepare it for use; take a handful of the leaves of sweet-briar, the same quantity of bramble-leaves; boil them in a gallon of water, with three or four handfuls of salt, about a quarter of an hour; strain off the liquor, and, having let it stand until perfectly cool, put it into an earthen vessel, and add to it the maw, prepared as above. To this is added a sound good lemon, stuck round with about a quarter of an ounce of cloves; which give the rennet an agreeable flavor. The longer the bag remains in the liquor, the stronger of course will be the rennet: the quantity, therefore, requisite to turn a given quantity of milk, can only be ascertained by daily use and observation. When the rennet is sufficiently strong, take out the bag; hang it up two or three days for the pickle to drain from it; re-salt it; put it down again into the jar; and thus continue to treat it until its virtues are exhausted; which will not be until it has been used several times. By suffering one or more bags to remain in the liquor, the rennet thus prepared may be raised to a very high degree of strength, as will appear in the following observations. The leaves and the spice, he says, it is probable, have no other effect than that of doing away the ill flavor of the maw; which, if ever so well cleaned, retains a faint disagreeable smell; whereas the rennet, prepared as above, is perfectly well flavored. It is however, he says, an idea among the Wiltshire dairy-women, that the leaves correct any rankness or evil quality in the milk, arising from a rankness of pasture: they being further of opinion, that different pastures require different sorts of herbs to correct them; and some of them, it seems, are, or pretend to be, so deeply versed in this art, that they will undertake to correct any milk, so as to prevent the rising, heaving, or blowing of the cheeses made from it; and, consequently, the rancidness which usually accompanies a porous cheese. This is, no doubt, a grand object of cheese-makers; but it is not, he apprehends, to be obtained by so small a proportion of vegetable juices as pass with the rennet into so large a proportion of milk. Nevertheless, it appears to him highly probable, that this grand desideratum lies within the reach of the chemical art; and that, by a course of judicious experiments, some vegetable or mineral preparation, adequate to this valuable purpose, may be discovered.

According to the same writer, in his Rural Economy of Gloucestershire, "the rennet made use of at Frocester was prepared in this manner:—To two gallons of water, made salt enough to bear an egg, add one penny-worth of mace, one penny-worth of cloves, a handful of sweet-briar and hawthorn buds, a small quantity of alum (about the bulk of a small walnut), the same quantity of salt prunella, a small quantity of cochineal (a small *pinch*—the bulk of half a hazel-nut), and, if to be had, two or three bay-leaves. Pound the alum, sal prunel, &c. and having mixed the several ingredients with the salt and water, add five *vells*, or, if small, six or seven. In about ten days the rennet will be fit for use."

And "another recipe which he was favoured with in this vale, is the following: three handfuls of common salt to three quarts of water, a quarter of an ounce of salt-petre, and as much black pepper as will lie upon a shilling, a small quantity of agrimony, a sprig of sweet-scented thyme, a handful of sweet-briar, a handful of the red buds of hawthorn, four heads of sage. Add the ingredients, and boil the water a quarter of an hour. To the liquor, when cold, put one *vell*. The rennet may be used next day."

It is observed that, next to the art of correcting the milk (an art as yet in its infancy), that of coagulating it seems to claim the attention of the experimentalist. It is known, from daily experience, that the warmer the milk is, when the rennet is put to it, the sooner it will coagulate, with a given quan-

tity of rennet of a given strength. It is equally well known, that the cooler the milk, and the longer it is in coagulating, the more tender and delicate the curd becomes: on the contrary, if the milk be too hot, and the coagulation takes place too rapidly, the curd proves tough and harsh. But it seems to be a fact equally well established, that a cheese made from milk which has been coolly and slowly coagulated, is longer before it becomes marketable than one made from milk which has undergone a less deliberate coagulation; and which, being drier, and of a harsher texture, sooner becomes cheesey, and fit for the taster. Therefore, the great art in this stage of the process, lies in the degree of warmth of the milk when *set*; that is, when the rennet is put to it; or, in the degree of heat retained by the curd when it *comes*, that is, when the coagulation has sufficiently taken place; or, in the length of time between the setting and coming. Which length of time may be regulated either by the degree of the warmth of the milk when set; or, by the state of warmth in which it is kept during the time of coagulatiou; or, by the quantity and strength, taken jointly, of the rennet.

In order to gain some information on this subject, Mr. Marshall made the following experiments:

In 1781, June 5, twenty-three gallons of milk, heated to ninety-six degrees of Fahrenheit's scale, with two tea-cupsfull of weakish rennet, came in one hour; the curd delicate and good. 6. The same quantity of milk, of the same heat, with the same quantity of rennet, came in nearly the same time; the curd somewhat tough; owing, probably, to the milk having been burnt to the kettle in which it was heated. 7. Twenty-seven gallons of milk, heated to ninety-four degrees, with the same quantity of rennet, came in about two hours; the curd very good. 8. Twenty-six gallons of milk, heated to one hundred and two degrees, with one tea-cupful of rennet, came in two hours and a half; curd very good. 9. Twenty-five gallons of milk, heated to one hundred degrees, with a tea-cupful and a half of rennet, came in about one hour and a half; the curd good, but somewhat tough; owing, perhaps, to the milk being kept too warm in the cheese-tub, by being covered up close with a thick cloth.

It is noted, that, on the 7th and 8th, the whey retained a heat of about eighty-eight degrees, whereas the whey this morning was ninety-two degrees: so that, perhaps, it is not the heat when it is set, but the heat when it comes, which gives the quality of the curd. 10. Twenty-five gallons: ninety-six degrees: two cups: uncovered: came in two hours and a quarter: whey eighty-seven degrees: curd very tender. 11. Twenty-three gallons: one hundred degrees: more than a tea-cup: uncovered: did not come in two hours; owing to the rennet being lower in strength than before; therefore added a little more rennet, which brought it in about three hours from first setting: the whey eighty-seven degrees: the curd uncommonly delicate. 12. Twenty-four gallons of milk: one hundred degrees: two cups of rennet: uncovered: came in two hours: whey eighty-nine degrees: curd uncommonly tender. 13. Twenty-eight gallons of milk: ninety-two degrees: three cups (say strongly rennetted): covered up with a coarse linen cloth: came in one hour and a half: whey eighty-six degrees: curd very good, and of a very fine colour, though, perhaps, would have handled tenderer if it had not stood some time, after it came, before it was broken up. Perhaps, says he, much depends on its being broken up in the critical minute. 14. Twenty-eight gallons: one hundred degrees: two cupsfull: uncovered: came in one hour and a quarter: whey ninety-four degrees: curd somewhat harsh, but of a good colour. The change of colour, therefore, he thinks, owing to the change of pasture.

He here notes, that the milk should be covered to make it come together: this came and grew hard at the bottom half an hour before it was set at the top.

15. Twenty-eight gallons: milk heated to ninety-five degrees: with two cups of rennet; and covered after it had stood three-quarters of an hour: came in one hour and a half: whey eighty-nine degrees (the morning warm): curd very good and tender. 16. Thirty gallons of milk, heated to one hundred and three degrees, but lowered, by two pailsful of cold water, to ninety-six degrees; with two cups and a half of rennet; and kept close covered: came in one hour: whey ninety-four degrees: curd pretty good, but not sufficiently tender. 17. Twenty-eight gallons: ninety-seven degrees: two cups and a half: covered, but not close: came in one hour and a half: whey not tried: curd somewhat tough.

It is noted, that the toughness was owing, perhaps, to some milk of a new-calved cow being among it. And, also, to try the exact heat of milk immediately from the cow, immerged a dish in the pail while milking. After it had lain long enough to receive a degree of heat equal to that of the milk in the pail, emptied it, and immediately milked into it from the teat (the cow being at this time about half milked); the heat ninety-five degrees: and, likewise, that the cheeses of yesterday (the 16th of June), press remarkably elastic and spongy, like a fungus: perhaps, owing to the milk's coming too hot; or, perhaps, to two or three of the cows be then a bulling; or, perhaps, being made thicker than usual, the press was not heavy enough for them; or, perhaps, this ill quality is owing to the cold water being put into the milk.

He afterwards found, that milk of a cow, on the day of amour, retained, after having stood some time in the pail after milking, ninety-eight degrees of heat. This shows that the state, if not the quality of the milk, is altered by the heat of the cow; and a cautious dairy-woman always endeavours to keep such milk out of her cheese-tub.

June 18. Thirty gallons: ninety-five degrees: covered: came in one hour and a half: whey ninety-two degrees: curd pretty good. 19. Thirty-gallons: ninety-two degrees: two cups: covered:

curd very good. 21. Thirty gallons: ninety-eight degrees: lowered by half a pail of cold water to ninety-five degrees: the curd good; but the cheeses, like those of the 16th press, hollow and spungy. Therefore, it is probable, from these two incidents, that lowering the heat of the milk with cold water has an evil effect. 23. (Evening) fifteen gallons of new milk, warm from the cow, retaining a heat of ninety-two degrees, with two cups and a half of new weak rennet, and closely covered, came in three-quarters of an hour: whey eighty-eight degrees: curd very delicate and good. 25. Forty gallons of half-skim milk, heated to eighty-seven degrees, with three cups of rennet, slightly covered, came in three-quarters of an hour: whey seventy-nine degrees: curd remarkably good of this sort.

On September 8, in observing the effect of some remarkably strong rennet, he found, that an ordinary tea-cupful coagulated sufficiently upwards of forty gallons of milk, heated to only eighty-eight degrees, in thirty-five minutes.

From the whole of these experiments, it appears, he thinks, that curd of a good quality may be obtained from milk heated from 87 to 103 degrees of Fahrenheit's thermometer; provided the rennet be so proportioned, that the time of coagulation be from three-quarters of an hour to two hours and a half; and provided the milk be kept properly covered during the process of coagulation. And from these, as well as a variety of other trials, which he made in the course of the summer, it appears to him, at present, that from 85 to 90 are the proper degrees of heat; that from one to two hours is the proper time of coagulation; and that the milk ought to be covered so as to lose in the process about five degrees of its original heat. But, says he, climature, seasons, the weather, and the pasture, may require that these bounds should sometimes be broken. A few observations, made in one season, and in one place, how accurately soever they may have been taken, are by no means adequate to the entire illustration of this very abstruse subject.

As no general rule has yet been established, whereby to determine either the quantity of rennet to be applied, or the proper temperature of the milk at the period of application, it can only be stated, that each dairy-maid is obliged to exercise her own discretion, according to the existing circumstances, in regulating her conduct in this respect. But although practice is the only means by which she can acquire a proper knowledge of this branch of the business, yet the consequences of proper or improper conduct, are well known in every cheese-dairy. When the coagulation is accelerated or retarded beyond the proper time, which, in making a 60lb. cheese, is reckoned an hour and a half, either by giving too much or too little rennet, or by applying it when the milk is too hot or too cold, not only the quantity of the curd is diminished, but the quality, in either case, materially effected. In the former case, it is of a tough gluey texture; in the latter, too tender.

It has been remarked, by Mr. Twamley, that he supposes, "that oftentimes, in very hot weather, the milk in a cow's udder, much agitated by driving, or running about, is in a state not very far different from that carried in a churn, which frequently makes the great difficulty in what is called bringing the cheese, or fixing the curd in the tub or pan: He has often heard dairy-women say, that it is sometimes very difficult to make it come at all, and instead of one hour (the time very commonly given by dairy-women, in bringing the cheese), that it will frequently not come in three, four, or five hours, and then in such an imperfect state, as to be scarce capable of being confined either in the cheese-vat or press, and, when released from the press, will heave, or puff up, by splitting or jointing, according as the nature or state of the curd happens to be. Whenever people find their cows in this situation, which, in hot summer-evenings, must often happen, especially where water is scarce, or in grounds where there is very little shade; then it is, that making use of a little cold spring-water before *earning* or *rendling*, is useful, as that will make the rennet take effect, and the milk coagulate, much sooner. It often happens, in some dairies, that the work is quite at a stand: the dairy-woman not knowing how to hasten the coagulum, or coming of the cheese, thinks of putting more rennet in to forward it; but the nature of rennet being such as will dissolve the curd in part coagulated, if more be put in, disturbs the whole, and prevents its becoming curd at all, or in a very imperfect state, remaining in the whey, in an undigested state, that will neither turn to curd or cream, and a principal part of the richest of the milk is then cast away with the whey. Cold water, with a little salt (as hereafter recommended), will, in a great measure, prevent this difficulty. One great point or thing to be observed in first setting off, or *rendling* the milk, is carefully to observe the state of the milk as to heat or cold: the grand medium, or state it should be in when you put the rennet into it, is what may be properly understood milk-warm; if you find it to be warmer than that, it is recommended to put some fresh spring-water into it, in such quantity as will reduce it to the milk-warm state: a quart, two, three, four, or more, according to the quantity of milk to be so cooled: many people may think water will hurt the milk, or impoverish the cheese; experience shews it will not, but is a means of the rennet more immediately striking or operating with the milk. He would recommend the use of a thermometer, to shew the degree of heat milk bears. He doubts not, one may be constructed on a very easy plan, that will cost a very little money, and it will be well worth while to be at a small charge to regulate a fault, of putting milk together too hot, which is of more ill consequence than people are aware of."

After the rennet has been applied, the milk-tub is covered up by a board, over which is laid a linen cloth; and having stood the usual time, the dairy-maid, on finding that the coagulation is completed,

sets to work, with her assistants, to separate the curd from the whey, an operation which is generally called *breaking and gathering the curd.*

And, simple as this business may appear, and uniform as one would expect the method to be, there are few particulars, says Mr. Donaldson, in the whole art of cheese-making, wherein so great a difference is observable in practice. In some dairies, the curd is at first broken, or cut in various directions with a cheese-knife, an instrument made for the purpose, and used with a view of making the whey separate easily, and without carrying off with it any richness from the curd. After these first incisions, some time is allowed for the broken curd to subside. The knife is then again used, and more freely than before; and while the dairy-maid stirs up the unbroken curd from the bottom, with the skimming-dish in one hand, she cuts the larger pieces of curd with the knife, which she holds in the other. See *Cheese-Knife.*

Having thus thoroughly broken the curd, and allowed some time for its subsiding, she then begins to take off the whey with the skimming-dish. In other dairies, not less celebrated for good cheese, the skimming-dish only is used in breaking the curd; and in order to facilitate the operation of separating the whey from the curd, some of the whey that first rises to the top is skimmed off, and being either heated or cooled, according to the state of the weather, and the required consistence of the curd, is again returned into the cheese-tub, and, after remaining a little time, the whole is laded off in the usual manner. All the whey that can be extracted without pressing having been removed, and the cheese-tub being raised at one side, the curd is collected into a mass, and at first pressed with the back of the skimming-dish. When no more whey can be discharged by this means, others more violent are adopted; the curd is, in many cases, cut with the cheese-knife, to give vent to the whey, and is then pressed as hard as possible with the hands; in others, a considerable weight is frequently applied. The curd having been, in a great measure, separated from the whey, it is put into two or three pans, or other vessels, and the dairy-maid and her assistants break it with their hands as fine as possible; in the course of doing which, a proper quantity of salt (for the weight or measure is scarcely in any instance ascertained) is scattered over the curd, and intimately mixed therewith. According to the method usually practised in Gloucestershire, when the curd is broken to the requisite fineness, it is again returned into the cheese-tub, when it is scalded, by pouring over the broken curd a pailful of hot water, or of whey, or of whey and water mixed. After the scalding water or whey is applied, the whole is briskly stirred, and, being allowed to stand for some time, for the curd to settle at the bottom of the tub, the scalding materials are skimmed or poured off, and the curd being pressed as before, so that no more whey can be extracted by such means as were formerly used, it is put into the vat, and pressed in the ordinary way. When it is properly broken, rubbed, and salted, a cloth is spread over the cheese-vat, an implement which, in Scotland, is called a *chessel*, and the broken curd being packed into it, and covered up with the cloth, a board is laid over the vat, and a weight, heavy in proportion to the quantity of curd, placed upon it, by which means the remaining whey is pressed out. Where the cheeses usually made are of a large size, as in Cheshire, the dairy-maid thrusts a number of iron skewers (through holes made in the side of the vat for the purpose) into the curd, in various directions. These being withdrawn, the openings made by them serve as so many drains for permitting the whey to run off. When the whey, in place of running freely, which it does at first, only falls in drops, the weight is removed, and the curd rebroken, and, being again put into the vat, is managed in the manner just described, and repeated while, by using such means, a drop of whey can be extracted. The curd being now almost entirely freed from the whey, it is again placed in the vat, a clean cloth having been previously spread for the purpose of receiving and inclosing it. The curd now takes the form at least of cheese, and the cover of the vat being laid on, it is placed in the cheese-press.

In Gloucestershire, Mr. Marshall observes, that, in the common practice of scalding the curd, the mass is broken, first by cutting it into square pieces with a common knife, and then reducing it, with the triple knife, into small fragments, mostly as small as peas; none of them is left larger than a walnut; and among these fragments the scalding stuff is thrown, stirring them briskly about, thereby effectually mixing them together; and, of course, scalding the whole as effectually and as evenly as this method of scalding will admit of. The liquid made use of for scalding curd, varies in different dairies. Some dairy-women scald with whey, violently objecting to water, while others use water, objecting with equal obstinacy to whey; while dairy-women in general, he believes, mix the two together. It seems to be understood, that different grounds require different kinds of scalding liquor. The quantity is in proportion to the quantity of curd; enough to float the curd, and make the mixture easy to be stirred about with the dish. Part of it is heated to near boiling heat, and this lowered with cold liquid, to a heat proportioned to the state of the curd: soft curd is scalded with hot, hard curd with cooler liquid. In scalding, therefore, the dairy-woman has a remedy for any misjudgment her sense of feeling may have led her into, in the stage of coagulation; let the curd come too soft, or too hard, she can bring it to the desired texture by the heat of the scalding liquid. And here seems to hinge, principally, the superior skill of the Gloucestershire dairy-woman: by running the milk cool, she can, in scalding, correct any error which has been committed in the former operation.

In Norfolk, the same author remarks, that this stage of the process is very short. Part of the whey being laded off, the remainder, with the curd, is poured into a cloth: the whey drains through; the curd is shook in the cloth, kneeded down into a vat; put

under a light press; or, perhaps, under a stone; the cloth once changed; the curd once turned; and a Norfolk cheese appears. The cows are milked, and the cheese completed, in ten or twelve hours. But the practice, in his dairy, has been uniformly this: as soon as the curd is come at the top, firm enough to discharge its whey, the dairy-woman tucks up her sleeves, plunges her hands to the bottom of the vessel, and, with a wooden dish, stirs the curd and whey briskly about: she then lets go the dish, and, by a circular motion of her hands and arms, violently agitates the whole; carefully breaking every part of the curd; and, at intervals, stirs it hard to the bottom with the dish; so that not a piece of curd remains unbroken larger than a hazel-nut. This is done to prevent what is called slip-curd, that is, lumps of curd which have slipped unbroken through the dairy-woman's hands; which, by retaining its whey, does not press uniformly with the other curd, but, in a few days, if it happens to be situated towards the rind, turns livid and jelly-like, and soon becomes faulty and rotten. This operation takes about five or ten minutes; or, if the quantity of curd be large, a quarter of an hour. In a few minutes the curd subsides, leaving the whey clear upon the top. The dairy-woman now takes her dish, and lades off the whey into the pail; which she empties into a milk-lead to stand for cream, to be churned for whey-butter. This is a practice peculiar to the cheese-counties, and forms no inconsiderable part of the profit of a dairy in such counties. In Norfolk, the whey, even from new milk, passes from the cheese-vessels immediately to the hog-tub. Having laded off all the whey she can, without gathering up the small pieces of the loose curd floating near the bottom of the vessel, she spreads a straining-cloth over her cheese-tongs, and strains the whey through it, returning the curd retained in the cloth into the cheese-tub. When she has got all the whey she can, by pressing the curd with her hand and the lading-dish, she takes a knife and cuts it into square pieces, about two or three inches square. This lets out more of the whey, and makes the curd handy to be taken up, in order to be broken into the vats. See *Whey-Butter*.

Every large dairy should be plentifully furnished with vats of different sizes, as when three or four cheeses are made at each meal, a number of vats become actually in use; and if there are not still a number empty, the dairy-woman becomes confined in her choice, and cannot proportion exactly her vats to the quantity of curd she happens to find in her cheese-tub; and keeping a little overplus curd from meal to meal, frequently spoils a whole cheese. Having made choice of a vat or vats, proportioned to the quantity of curd, so that the cheese, when fully pressed, shall neither over nor under fill the vat, she spreads a cheese-cloth loosely over the vat, into which she re-breaks the curd, carefully squeezing every part of it in her hands; and, having filled the vat heaped up, and rounded above its top, folds over the cloth, and places it in the press, on the construction and power of which much depends. See *Cheese-Press*.

The management of the cheese in the cheese-press is this:—When the vat is properly placed in the press, the ordinary degree of pressure is applied, which is more or less according to the sizes of the cheeses usually made. At all large dairies, there are two or three presses, all varying in respect to weight or pressure. As soon as the vat is placed in the press, and the weight applied, skewers are thrust in through the holes in the side of the vat; this is done repeatedly during the first day the vat is in the press. From the time the vat is first placed in the press, till it is again taken out, does not, in ordinary cases, exceed two or three hours. When taken out, the cheese is put into a vessel, with hot whey, with a view of hardening its coat or skin, where it stands for an hour or two; it is then taken out, wiped dry, and after having remained some time to cool, it is covered with a clean dry cloth; and the vat being wiped dry, and the cheese replaced, it is again put into the press. In the evening, supposing the cheese to have been made in the morning, which is the usual time, it is again taken out of the vat, and another dry cloth being applied, it is turned and replaced, what was formerly the upper, becoming now the under side. In this manner, it is taken out, wrapped in clean cloths, and turned in the vat twice a-day, for two days, when it is finally removed.

In autumn, it is observed by the author of the Rural Economy of Norfolk, when the weather got cool and moist, the curd was scalded, to make the cheese come quicker to hand (that is, sooner saleable), and to prevent a white woolley coat from rising. It is done thus: if from new milk, scalding water (boiling water, with a small quantity of cold whey mixed with it) is poured over the whole surface of the curd, as it lies at the bottom of the cheese-tub: if from skimmed, or other inferior milk, the outsides only are scalded, after the curd is in the vat, by first pouring the scalding water on one side, and then, turning the cheeseling, pouring it on the other. For if in this case the curd were to be scalded, it would render it hard, and spoil the taste and texture of the cheese. In the scalding the cheeseling, the curd is first put into the bare naked vat, and the upper part scalded: the cheese-cloth is then spread over it, and the vat being turned, the curd falls into the cloth: the curd, with the cloth under it, is then put into the vat; the outer edges pared off; the paring broken, and rounded up in the middle; and the scalding water poured upon it as before; the folds of the cloth laid over, and the vat set in the press. The whey being pretty well pressed out, and the cheeseling (whether it has been scalded or not) having got firm enough to handle, which it will be in about half an hour, the dairy-woman takes it out of the vat; washes the cloth in a pail of clean cold water; spreads it over the vat; turns the cheeseling upon it; squeezes it gently into the vat; folds over the cloth; tucks in the corner with a wooden cheese-knife, and replaces the vat in the

press. Supposing the cheeseling to be made in the morning, it now remains in the press, untouched, until the evening; when it is taken out, salted, put into a fresh dry cloth, and left in the press all night. Next morning, if the curd be rich, or has been cold-run, the cheeseling is turned into another dry cloth, and left in the press till evening: but if, on the contrary, the curd be from poor milk, or from milk which before setting had acquired any degree of sourness, or if it has been run hot and quick, the cheeseling should in the morning be bare-vatted; that is, be put into the vat without a cloth round it, and be put again into the press until evening. The use of bare-vatting is to take out the marks of the cloth, and thereby evade a waste of labour in bringing the cheese to a smooth glossy coat. The reason for the above distinction is, therefore, obvious; for the harder the curd, the longer the marks of the cloth are in pressing out. In the evening, that which was turned into the dry cloth in the morning is now bare-vatted; and that which was bare-vatted in the morning, is now turned in the vat: and, having stood in the press until morning, the process is finished. The cheeses are taken out of the vats, and placed upon the shelf. Thus, says he, supposing the cheeseling to be made on Monday morning seven o'clock, it is between eight and nine taken out of the vat, the cloth washed, and immediately placed in the press again. On Monday evening it is salted, and, if wanted, pared; put into a dry cloth, and replaced in the press. On Tuesday morning it is bare-vatted, or the cloth changed; the cheeseling, in either case, being turned, and again put into the press. On Tuesday evening it is again turned; and on Wednesday morning finally taken out of the vat and press. The objects of this most laborious department of cheese-making are, to preserve the cheese sound in itself, and to give it such an appearance as will recommend it to a purchaser.

The *salting* of cheese is the next part of the management. The cheese, on being for the last time taken out of the vat, is carried to the salting-house, and placed in the vat in a tub filled to a considerable depth with brine, in which it stands for several days, being regularly turned once at least every day. The vat is then removed from the brine-tub; and the cheese being taken out, is placed on the salting-bench, where it stands for eight or ten days, salt being carefully rubbed over the whole every day during that period. When the cheese is of a large size, it is commonly surrounded with a wooden hoop, or fillet of cloth, to prevent renting. After it is supposed to be sufficiently salted, it is washed in warm water or whey, and, when well dried with a cloth, is placed on what is called the drying-bench, where it remains a like period before it is removed to the keeping-house or cheese-chamber. In some dairies, the new cheeses are not put in brine, but kept in the vats on the salting-benches; and after being rubbed with salt, and turned in the vats daily for a week or ten days, the vats are removed, and the cheeses managed in the manner above-mentioned. In several other dairies, again, the cheeses are salted while the operation of pressing is performing. At every time they are taken out of the press for the purpose of being turned in the vats, they are well rubbed with salt, which, for small thin cheeses, such as are commonly made in Wilts and Gloucestershire, is found to be sufficient; and, therefore, when taken for the last time from the press, in place of any more salt being applied, they are set at once upon the drying-benches. In short, the practice of immerging new-made cheeses in brine is only adopted when they are of so large a size, that rubbing salt on the outside would not be sufficient for answering the intended purpose.

It is stated by Mr. Twamley, that "sometimes, if a cheese be laid cool when first made, or, coming from the press, it is dried outwardly by means of a harsh cool air, when at the same time the inside of the cheese remains in a moist state, though the coat is hard and dry, when that cheese is exposed to heat, either by lying near a hot wall, or near tiles in hot weather, or by the immediate heat of the sun, it will be drawn up round, in the same manner, and by the same cause, that a board is made round, or coffered up, by the heat of the sun: rank cheese very often heaves, from the cause before given, that makes it rank. Cheese is very apt to split, or divide in the middle, by being salted within, especially when people spread salt across the middle of the cheese when the vat is about half filled, which curd, though in a small degree separated by salt, never closes or joins, and is much easier coffered up or drawn round than other cheese; especially thin cheese made in what we call Gloucester vats, being round or rising in the bottom, and the slider or cheese-board that is laid over it, made convex also, in order to make the cheese thinnest in the middle, that it may dry quick for early sale. Then, if salted within, and being laid soft on the shelf to dry, as it bears only on the edge all around, it is almost sure to split, and it is often seen; scarce a cheese in some dairies of this form but what do split. Salting a little in the milk is greatly preferable, for these dairies in particular."

The last part of the business is *the management in the cheese-room*.—When the cheeses are properly salted, and have acquired a competent degree of dryness, they are carried from the salting-place to the cheese-room, or store-house; where, after being smeared with fresh-butter, they are laid on the floor, or on shelves erected for the purpose. For the first ten days or a fortnight after they are placed in the store-room, they are pretty smartly rubbed every day, and the smearing with butter repeated; and although after that period it is only necessary to rub them two or three times a week, yet they should be turned every day while in the dairy-man's possession, which is longer or shorter according to the season of the year, and the demand at the principal markets.

It is remarked by Mr. Marshall, in the Rural Economy of Gloucestershire, that, in the management on the dairy-shelves, the young cheeses are turned every day, or every two or three days, according to the state of the weather, or the fancy or judgment of the dairy-women. If the air be harsh and dry, the windows and door are kept shut as

much as may be; if close and moist, as much fresh air as possible is admitted. Having remained about ten days in the dairy (more or less according to the space of time between the washings), they are cleaned, that is, washed and scraped, in this manner: a large tub of cold whey being placed on the dairy-floor, the cheeses are taken from the shelves and immerged in it, letting them lie perhaps an hour or longer, until the rind becomes sufficiently supple. They are then taken out, one by one, and scraped with a common case-knife, somewhat blunt, guiding it judiciously with the thumb placed hard against its side, to prevent its injuring the yet tender rind; continuing to use it, on every side, until the cloth marks and every other roughness be done away; the edges more particularly being left with a polished neatness. Having been rinsed in the whey, and wiped with a cloth, they are formed into an open pile (in the manner raw bricks are usually piled) in the dairy-window, or any other airy place, to dry, and from thence are removed into the cheese-chamber. The floor of the cheese-chamber is generally prepared by rubbing it with bean-tops, potatoe-haulm, or other green succulent herbage, until it appear of a black wet colour. If any dirt or roughness appear upon the boards, it is scraped off with a knife, and the floor swept clean with a hair-broom. The cheeses are then placed upon it regularly in rows, and kept turned twice a week, their edges wiped hard with a cloth once a week, and the floor cleaned, and rubbed with fresh herbs once a fortnight. The preparation of the floor is done with the intention of encouraging the blue coat to rise. To the same intent the cheeses are not turned too frequently; for the longer they lie on one side without turning, the sooner the blue coat will rise. If, however, they be suffered to lie too long without turning, they are liable to stick to the floor, and thereby receive injury. If, by accident or otherwise, the coat come partially, it is scraped off. This, however, seldom happens in a rich-soiled country, and all the care and labour requisite in this stage is to turn them twice a week, wipe their edges once a week, and to prepare the floor afresh once a fortnight. If the cheese-chamber be too small to admit of the whole being placed singly, the oldest are doubled; sometimes put three or four double. It is striking, says he, to see how well cheeses of this district bear handling at an early age: even at the time of washing, the dairy-maid will frequently set the cheese she is scraping on edge upon another, lying flat on the table, without injury. At a month old they may be thrown about as old cheeses. Their rinds appear as tough as leather. This must be owing to the scalding: it cannot be owing to their poverty. They are evidently richer and fatter than the new-milk cheeses of many districts.

And in the Rural Economy of Norfolk, the same author says, that cheeses newly made frequently acquire a white scurfy coat; which, besides hiding, if not causing, the defects of the cheese, is at least unsightly, and is a certain mark of the slovenliness of its maker. This scurf arises more plentifully on a poor than on a rich cheese. Cold moist weather encourages it; but in warm weather, the oily exudation of a rich and well-made cheese goes near of itself to eradicate the white, and bring on that desirable blue coat, which is at once a criterion of the goodness of the cheese, and of the skilfulness of the dairy-woman.

The first week or ten days, the new-made cheeses are carefully turned once a day; great care being had not to break the yet tender rind in turning; nor to suffer it to be cracked by too free an admission of a dry parching air. As soon as they are become firm enough to be handled with safety, they are cleaned in this manner: Some skimmed whey being put into a milk-lead, or other broad, shallow vessel, so as to cover the bottom of it half an inch or an inch deep, the cheeses to be cleaned are taken from the shelf and placed in the whey. One side being thoroughly moistened, the other side is placed downward: the edges too are wetted with a cloth, so as to make the whole coat of the cheese soaking wet. The dairy-woman then takes a hard brush, and brushes every part of the cheese; frequently dipping her brush in the whey, to eradicate the white coat more readily and more effectually. This done, she places them again on the shelves; but before they be quite dry, while their coats are yet moist; she rubs them over with a cloth, on which a piece of whey or other common butter has been spread. This keeps the rind supple, and free from cracks; checks the scurfy coat from rising; and, by stopping the pores and fissures of the coat, prevents the fly from depositing her eggs. If the rind be rough, from the marks of the cloth or other cause, she scrapes them with a knife, or other instrument: this last operation, however, is as yet performed with great care and delicacy. Having thus washed and scraped them two or three times (in the course of about a week from the first cleansing) she removes them from the dairy-shelves into some spacious airy room, with a firm even floor, which she first rubs plentifully with green succulent nettles, so as to give it a temporary greenness, and then places her cheeses in rows upon the prepared floor. She now washes them no more; but if the coat be yet rough, and the scurf continue to rise, she scrapes them more freely than before; and, as the rind gets harsh, softens it with butter; thus continuing to treat them, and still continuing to turn them once a day, until they acquire a rich golden polish, and the blue coat begin to show itself. This crisis, namely, the appearance of the blue coat, is not altogether regulated by the age of the cheese, but depends on its quality and the state of the weather. Perhaps it may appear before the cheese be one, perhaps not until it be more than two or even three months old; therefore, no certain number of cleanings can be fixed; these rules, however, may be observable: scrape and rub them, until they be perfectly smooth; mellow the rind with butter, whenever, for want of natural exudation, their coats get dry and harsh; thus continuing to keep them smooth, yellow, and glossy, until the blue coat begin to make its appearance voluntarily; and then, but not before, begin

to encourage the blue coat. This ingenious process is thus conducted:—Having rubbed the floor thoroughly with fresh nettles, the dairy-woman places such of the cheeses upon it as she judges to be ready for coating; and, upon the top of each cheese, puts three or four vine-leaves; or, for want of these, a cabbage-leaf. This, if the cheese be good, will in a day or two bring up the desired vestment: but, in inferior cheese, will take a longer time in coating; and as the leaves lose their greenness and succulence, she replaces them with fresh ones; and as she turns the cheeses, which is now done every second or third day, she re-covers the upper sides with leaves; but wipes their edges hard with a clammy cloth; so that the edge, and a narrow ring round each side, ever retain the polished yellow hue. When the circles are properly coated, and their edges have got sufficiently firm, they are placed on edge in a cheese-rack, and, without further care, except once a week moving them a little round, and now and then wiping their edges, remain there until the time they are sent to market. See *CheeseRack*.

It is, Mr. Marshall says, "a fact well established, that the season has great influence on the quality of cheese; especially on the defect (spliting) more immediately under notice. In 1783, a dry hot summer, scarcely any dairy could make good cheese. In some dairies more than half the make was hollow, and even in the best dairy he had an opportunity of examining, numbers were "eyey;" while, in a common season, and more especially in a cool summer, the same dairy has scarcely a defective cheese.

"In North Wiltshire, an experienced and very intelligent dairy-woman observed, that when the "crazey" (the crowfoot) is in full blow, she finds her cheese particularly inclined to heave; while a dairy-farmer of the highest class in the same district has observed, that when the creeping trefoil, white clover *(trifolium repens)*, has been in full blow, and in particular abundance, he has heard the loudest complaints of the licentious disposition of the cheese. It is not probable that any one species of plants is the sole cause of the disorder. Almost every cheese has its peculiar flavor, and its different degree of acrimony. Nothing is more likely to give that almost caustic quality, which some cheeses are possessed of, than the common and bulbous crowfoots: not only their flowers, but their leaves, are singularly acrid. On the other hand, there are several circumstances which render it probable that a redundancy of the creeping trefoil tends to aggravate the disorder. Dry seasons, by keeping the grass short, give it an opportunity of spreading. Manure is well known to encourage it; sometimes in a singular manner. Sheep-feeding pasture grounds produce a similar effect, partly owing perhaps to the blade-grasses being kept short; and in part to the soil being meliorated by a fresh manure; and it has been observed, that a suit of cow-grounds, which have been occasionally fed hard with sheep, are very difficult to make cheese from: while a few sheep among cows may, by picking out the clover, be serviceable to the dairy."

Mr. Twamley says, that "cheese made from clover is rather more difficult to make, to even the best of dairy-women; but he has seen very good sound dairies of stout, full-flavoured, cheese made from clover, especially when a good deal of time is allowed to bring the cheese, and care is taken not to let it lie too hot after it begins to get dry."

And he adds, that "it has generally been reckoned, that the milk required to make one pound of butter, will make two pounds of cheese, and a larger quantity where land is poor, the milk being weak, will not afford so much cream."

The produce of a dairy of cows, where the milk is converted into cheese, is very variously stated by different writers. In some districts, two hundred weight and a half from each cow, whether a good or bad milker, if at all in milk, is considered a good return. In others, the average runs as high as three; and in the county of Wilts in particular, from three and a half to four is the usual quantity. From accurate calculations made by Mr. Marshall, and these several times repeated, he found, that in Gloucestershire about fifteen gallons of milk were requisite for making little more than eleven pounds of two-meal cheese, and that one gallon of new milk produced a pound of curd. It is the general opinion of dairy-farmers, that the produce from two and a half to three and a half acres is necessary to maintain a cow all the year round. Taking, therefore, the medium of the three averages of cheese above-mentioned (amounting to 355lb. from each cow), the quantity of cheese by the acre is 118lb. Every calculation of this kind must, however, be extremely vague and uncertain. The correctness of the one now stated is, however, to a considerable degree confirmed by Sir William Petty's statement, in his Political Anatomy of Ireland, in regard to the quantity of milk which he supposed the cows in that country to yield in the year, viz. for ninety days three gallons, for other ninety days one gallon; for the next ninety days a quarter of a gallon, and for the remainder of the year, none, making in all, three hundred and eighty-four gallons; which, considering that in every dairy a certain quantity of cream is abstracted before the milk is put into the cheese-tub, it may be supposed, when converted into one-meal or two-meal cheeses, to make little more or less than 355lb. as has been just stated.

In addition to the preceding account, in which the method adopted for making cheese in some of the best-managed dairies in the kingdom are laid down, directions for making some other sorts of cheese may be given.

According to Mr. Chamberlayne, "the general mode of making Cheshire cheeses is from 50lb. to 60lb. weight each, and which now sell, from good dairies, at from 43*s*. to 55*s*. per 120lb. and upwards.

"The process of making these cheeses is as follows, viz. on a farm capable of keeping twenty-five cows, a cheese of about 60lb. weight may be daily made in the months of May, June, and July.

"The evening's milk is kept untouched until next

morning, when the cream is taken off, and put to warm in a brass pan, heated with boiling water; then one-third part of that milk is heated in the same manner, so as to bring it to the heat of new milk from the cow." He observes, that "this part of the business is done by a person who does not assist in milking the cows during that time; let the cows be milked early in the morning, then the morning's new milk, and the night's milk, thus prepared, are put into a large tub, together with the cream; then a portion of rennet, that has been put into water milk-warm the evening before, is put into the tub, sufficient to coagulate the milk; and at the same time, if arnotta be used to colour the cheese, a small quantity, as requisite for colouring (or a marigold or carrot infusion) is rubbed very fine and mixed with the milk, by stirring altogether, then covering it up warm, it is to stand about half an hour, or until coagulated; at which time it is first turned over with a bowl, to separate the whey from the curds, and broken soon after with the hand and bowl into very small particles: the whey being separated by standing some time, is taken from the curd, which sinks to the bottom; the curd is then collected into a part of the tub, which has a slip or loose board to cross the diameter of the bottom of it, for the sole use of separating them, and a board is placed thereon, with weights from 60lb. to 120lb. to press out the whey; when it is getting into a more solid consistence, it is cut and turned over in slices for several times, to extract out all the whey, and then weighed as before; which operations may take up about an hour and a half. It is then taken from the tub, as near the side as possible, and broken very small by hand, and salted, and put into a cheese-vat, enlarged in depth by a tin hoop to hold the quantity, it being more in bulk than when finally put into the press; then press the side well by hand, and with a board at top well weighted, and placing wooden skewers round the cheese to the centre, and drawing them out frequently, the upper part of the cheese will be drained of its whey; then shift it out of the vat, first put a cloth on the top of it, and reverse it on the cloth into another vat, or the same, which vat should be well scalded before the cheese is returned into it; then the top part is broken by hand down to the middle, and salt mixed with it, and skewered as before, then pressed by hand, weighted, and all the whey extracted. This done, reverse the cheese again into another vat, warmed as before, with a cloth under it; then a tin hoop, or binder, is put round the upper edge of the cheese, and within the sides of the vat, the cheese being first inclosed in a cloth, and the edges of it put within the vat."

In respect to the cloth, he observes, that it "is of fine hemp, one yard and a half long by one yard wide; it is so laid, that on one side of the vat it shall be level with the side of it, on the other it shall lap over the whole of the cheese, and the edges put within the vat, and the tin fillet to go over the whole. All the above operations will take from seven in the morning till one at noon. Finally, it is put into a press of 15 to 20 cwt. and stuck round the vat, into the cheese, with thin wire skewers, which are shifted occasionally; in four hours more it should be shifted and turned, and in four hours more the same, and the skewering continued. Next morning let it be turned by the woman who attends the milk, and put under another or the same press, and so turned at night and the next morning; at noon, taken out finally to the salting-room, there salt the outside, and put a cloth-binder round it. The cheese should, after such salting, be turned twice a day, for six or seven days, then left two or three weeks to dry, turned and cleaned every day, taken to the common cheese-room, laid on straw on a boarded floor, and daily turned until grown hard. The room should be moderately warm, but no wind or draught of air should be permitted, which generally cracks them. Some rub the outsides with butter or oil, to give them a coat."

In the making of *Parmesan* cheese, we are informed by Mr. Price, in the seventh volume of the Letters and Papers of the Bath Society, that the method pursued by Signor Vitabni, is "to put, at ten o'clock in the morning, five brents and a half of milk, each brent about forty-eight quarts, into a large copper, which turns on a crane, over a slow wood-fire, made about two feet below the surface of the ground; the milk is stirred from time to time, and about eleven o'clock, when just luke-warm, or considerably under a blood-heat, a ball of rennet, as big as a large walnut, is squeezed through a cloth into the milk, which is kept stirring. By the help of the crane, the copper is turned from over the fire, and let stand till a few minutes past twelve; at which time the rennet has sufficiently operated. It is now stirred up, and left to stand a short time. Part of the whey is then taken out, and the copper again turned over a fire sufficiently brisk to give a strongish heat, but below that of boiling. A quarter of an ounce of saffron is now put in to give it a little colour; and it is well stirred from time to time. The dairy-man frequently feels the curd. When the small, and, as it were, the granulated parts, feel rather firm, which is in about an hour and a half, the copper is taken from the fire, and the curd left to fall to the bottom. Part of the whey is taken out, and the curd brought up in a coarse cloth, hanging together in a tough state. It is then put into a hoop, and about a half hundred weight laid upon it for about an hour; after which the cloth is taken off, and the cheese placed on a shelf in the same hoop. At the end of two, or from that to three days, it is sprinkled all over with salt; the same is repeated every second day for about forty or forty-five days, after which no further attention is required. While salting, they generally place two cheeses, one upon another; in which state they are said to take the salt better than singly.

The whey is again turned into the copper, and a second sort of cheese is made, and, in some cases, afterwards even a third."

Cream-cheese is made in various places, but that which is generally known by the name of Stilton, is made in Leicestershire, the process of which, ac-

cording to the Agricultural Report of that county, is this: The night's cream is put into the morning's new milk with the rennet, and when the curd is come, it is not broken as is done with other cheeses, but taken out with a soil-dish altogether, and placed in a sieve to drain gradually; and as it drains kept gradually pressed, till it becomes firm and dry; then placed in a wooden hoop, and afterwards kept dry on boards, turned frequently, with cloth binders round it, which are tightened as occasion requires

Cream-cheese of good quality is likewise made in some districts, by adding the cream of one meal's milk to that which is immediately taken from the cow. This, after being made and pressed gently two or three times, and carefully turned for a day or two, is fit for use.

In some districts, the method of making *green cheese* is this: for a cheese of ten or twelve pounds weight, about two handfuls of sage and one of marigold-leaves and a little parsley, are bruised and steeped one night in milk. Next morning the greened milk is strained off, and mixed with about one-third of the whole quantity to be run. The green and the white milks are then run separately, keeping the two curds apart until they be ready for vatting. The method of mixing them depends on the fancy of the maker. Some crumble the two together, mixing them evenly and intimately; others break the green curd into irregular fragments, or cut it out in regular figures with tins for this purpose. In vatting it, the fragments or figures are placed on the outsides. The bottom of the vat is first set with them, crumbling the white or yellowed curd among them. As the vat fills, others are placed at the edges, and the remainder buried flush with the top. The after-treatment is the same as that of plain cheeses.

There are a few other circumstances that deserve to be mentioned, which relate to the difference of the milk employed in making cheese. Where the whole milking is immediately made use of for the making of the cheese, it is termed one-meal cheese, and the milk in such cases is mostly made use of in its natural state. But when two-meal cheese is made, the quality of milk used is very different. In many cases, the whole of the cream of the first meal is abstracted, and in every case a certain portion. In general the quantity is very uncertain, depending on the quality of the pasture, and not a little on the disposition of the farmer in regard to avarice; or, in other words, a desire to make the most of his dairy, without being solicitous about the character or superior excellence of his cheese. In the dairies where this is the practice, the milk of the first meal is set abroad in the leads or other vessels in the usual manner; and as it is the evening's milk that is in common added to that of the succeeding morning, the operation of cheese-making commences immediately after that of the morning making is completed, that is, about five or six o'clock. The cream of the evening milk being skimmed off, the milk is carried and put into the cheese-tub, reserving sometimes a half, sometimes a third, but more frequently only three or four gallons, to be applied to the following purposes. The milk that is reserved, which we may suppose to be three or four gallons, being put into a brass pan and made scalding hot, by placing the pan in a furnace or vessel of hot water, the half of it is poured into the cheese-tub among the cold milk, and the other half into the pan in which the cream had been put. The cream and the hot milk being intimately mixed together, the whole is poured into the cheese-tub, which by this time has received a great addition, if not the whole of the morning's milk, warm from the cows. Thus the milk of the former evening, warmed to a certain degree by the means above-mentioned, together with the cream after it has been returned as much as possible into the milky state, by being incorporated and intimately blended with part of the scalded milk, and added to the milk new drawn from the cows, forms, as it were, a body of fluid of the same nature, equal in quality and temperature, and to which rennet is applied in the usual way. The above method of re-mixing, or in the dairy phrase melting the cream, is, Mr. Donaldson believes, the best that is any where practised: but it appears extremely doubtful, he observes, whether this method is so effectual for answering the intended purpose, as to render cheese made of milk so managed, and without the addition of any fresh from the cow, equal in quantity and quality to that made entirely of new milk.

Where skim-milk cheeses are made, the milk is set out in the leads or cisterns, or other vessels, generally to the depth of the second joint of the dairymaid's forefinger, that being the gauge most usually applied. In this state it remains longer or shorter, according to the weather, care being taken to skim off the cream, or to drain off the milk, in proper time, before it begin to acquire a sourish taste. If that should at any time happen, either from the excessive heat of the weather, or owing to some inattention in the general management, in place of putting the skimmed milk into the furnace to give it that degree of heat supposed necessary for facilitating the coagulation after the rennet is applied, and which is the usual practice, the method is, to put it directly into the cheese-tub, and to pour in such a quantity of hot water as will give the wished for temperature. By this means, the risk of the milk breaking while heating in the furnace, which, when not quite sweet and fresh, it is apt to do, is avoided, while the intention must in every other respect be as fully answered. After the milk is heated by either of the means above-mentioned, and put into the cheese-tub, the only particular necessary to be attended to in making this sort of cheese, beyond what has been already explained, is to add somewhat more rennet than is usually applied to a similar quantity of milk, which contains either the whole or a great portion of the cream.

Cheese-*Board*, a circular piece of board, about an inch or an inch and a half in thickness, upon which the new-made cheeses are placed on the shelves of the cheese-room. Cheese-boards should be made of such sorts of wood as are the least liable to warp, and be planed smooth on both sides.

Cheese-*Colouring*, the material employed for giving colour to cheeses. See *Annotta*.

Cheese-*Cloth*, the cloth in which the cheese is placed in the press.

Cheese-*Knife*, a large sort of knife or spatula made use of in some dairies for the purpose of cutting or breaking down the curd, while in the cheese-tub.

Cheese-*Lep*, the bag in which dairy-women prepare and keep the rennet for making cheese. See *Rennet*.

Cheese-*Press*, a press employed in cheese-dairies, for the purpose of forcing the whey from the curd when in the cheese-vat, by means of pressure. It is observed, by the author of the Rural Economy of Norfolk, that, in making cheese, much depends on the construction and power of the press, the excellency of which arises from its pressing level. If it have too much play, so as to incline and become tottering, or leaning one way or another, and do not fall perpendicularly upon the cheese-board, one side of the cheese will frequently be much thicker than the other; and, what is still worse, one side will be thoroughly pressed, while the other is left quite soft and spongy. The power of this machine may be given in different ways, as by the screw, the lever, or by a dead weight; and it ought always to be proportioned to the size and thickness of the cheese. The author just mentioned, found one that was constructed on these principles highly useful and convenient; the power of which was a dead weight of stones, contained in a cubical box, moving in grooves, so as to keep its bottom horizontal; the medium weight, one hundred weight and two quarters, but regulated by the stones, agreeably to the thickness of the cheese or cheeses to be pressed. In the vale of Gloucester, he says, the presses are mostly loaded with gravel, in cubical boxes, raised by rollers, and made to fall horizontally on the cheeses. At Maberley, they use a double press; each division of it holding six or eight of these cheeses. A press of the most usual kind is represented in *pl.* XVIII. *fig.* 1. in which *a b* is the press, *c e* and *f g* levers, moveable about the points *d c f g*, by applying the hand at *c*. *s* the stone or weight, and *h* the cheese to be pressed.

Cheese-*Rack*, a contrivance made for the purpose of receiving and containing such cheeses as have become sufficiently firm and coated. These racks may be constructed in different ways; but Mr. Marshall thinks, that the plate-rack, with four or five tier one above another, is the best form. If the cheeses intended to be placed in it be nearly or one size, the rack should be made the same width at the top as the bottom: but if they be of different sizes, it ought to be made narrower at the top than at the bottom; and if they be of different thicknesses, as well as of different diameters, the spaces for the respective cheeses should likewise be varied. A small rack may be slung, with a rope and pullies, at each end of the cheese-room; so as to be drawn up and lowered down at pleasure, but a large one is difficult to sling, in a common room, in that manner; it ought, therefore, to stand on legs about two feet high, with a broad base-board projecting over the legs, so as to prevent vermin from climbing up into the racks; this kind saves labour in turning, collects the cheese into a small compass, and put it out of the way of vermin.

Cheese-*Room*, a room appropriated for the reception of cheeses while they remain in the hands of the maker. Rooms of this kind are frequently fitted up with shelves, and, in some, an entire lining is put round the walls, with a stage or two in the middle, gangways being left wide enough to pass conveniently between them. In one dairy, in North Wiltshire, Mr. Marshall says, he remarked an admirable arrangement of cheese-rooms. The shelf-room was immediately over the dairy-room, and the lofts over the shelf-room, with trap-doors in each floor, to hand the cheeses through. This, he observes, is a plan which saves much awkward carriage, and which might be adopted with advantage in every dairy which will admit of it.

Cheese-*Tongs*, a sort of wooden frame, placed occasionally on the cheese-tub, on which the vat is set, in order that the whey may drain from tho curd.

Cheese-*Tub*, the tub in which the curd is broken and prepared for being made into cheese. Tubs of this kind are of different shapes, as round and oval, and of such capacities as are requisite for containing such quantities of milk as are intended to be converted to the purpose of cheese.

Cheese-*Vat*, a strong kind of wooden hoop, with a bottom, which, as well as the sides, is perforated with holes, through which the whey escapes during the time the cheese is pressing. The cheese-board is so formed as to pass within the hoop part of the vat, and receive the weight or power of the press. Dairies, Mr. Marshall observes, should be well furnished with vats of different sizes, as where three or four cheeses are made at each meal, a number of vats become actually necessary; and, if there be not some to spare, they cannot be so well suited to the stock of curd which may be had; and keeping a little overplus curd, from meal to meal, may often spoil a whole cheese.

CHEESE-RENNET, a sort of weed. See *Yellow Ladies Bedstraw*.

CHERRY-TREE, a tree of the plum kind. frequently cultivated in the field for the sake of the fruit. Of this sort of tree, there are many varieties. In Kent, they generally prefer, for this fruit, a situation where there is a deep surface of loam upon the rock. But, by some, it is said, that there is not any necessity for a great depth of soil. In respect to distance apart, cherry-trees require to be planted according to their sorts; a *heart* requiring double the distance of a *duke* or *morello*. But when planted by themselves, they are generally placed from twenty to thirty feet distant, and are put somewhat deeper in the earth than apples; but, in other respects, the management is the same. See *Orchard* and *Apple-Tree*.

Cherry-*Orchard*, that sort of orchard-ground in which cherry-trees are chiefly planted. They

are very common in the county of Kent. See *Orchard.*

Cherry-*Wine*, a kind of wine made from the juice of cherries, by means of fermentation. For making this sort of liquor, the cherries should hang upon the trees till they are thoroughly ripe, in order that their juice may be better perfected and enriched by the sun; and they should be gathered in dry weather. The juice is then to be pressed out, and a quantity of sugar proportioned to the intended strength of the wine is to be added, and the whole regularly fermented. When the wine is become fine, it must be bottled for use.

CHESNUT-TREE, a well-known *deciduous* tree, of which there are several varieties. Trees of this sort frequently grow to a great height and thickness, affording good timber and excellent shade. The leaves are large, of a beautiful green colour, and continue late in the autumn. These trees may be most readily propagated by planting the nuts in beds of fresh earth, without dung, in February. The best nuts for this purpose being those brought from Spain and Portugal, and which have not been kiln dried, a method which is frequently practised to prevent sprouting.

When they cannot therefore be procured from abroad in a sufficiently fresh and vegetating state, the English nuts should be made use of, which are equally good for sowing where the intention is timber or beauty, but the fruit which they produce is much smaller. The nuts should be preserved in sand, till the time of using them, to prevent the mice or other vermin from destroying them: and, before they are planted, it may be proper to try their goodness, by putting them in water, and rejecting such as swim upon the surface. In planting, they may either be put in drills of about four inches in depth, the same distance between the rows and from each other in them, three or four rows constituting a bed; or they may be set by means of a dibble in similar rows and beds. The last is probably the safest method, where the ravages of vermin are apprehended. In these beds, they are generally allowed to remain two years, care being taken to keep them clean and free from weeds, after they first appear, which will be about April. When removed to the nursery, they must have wider distances both in the rows and between them. The seasons for transplanting these trees are either in October, or the latter end of February, the former should probably in general be preferred. The distances in which they are generally set out, are three feet, row from row, and one foot in the rows. When these trees have a downright or tap-root, it should be cut off, especially when they are intended to be removed again, as this will occasion their throwing out lateral roots, and render them less liable to miscarry when finally planted. The length of time allowed them in the nursery is generally three or four years, according to their growth; but the younger they are planted, the better they succeed. Such as have crooked stems frequently become more straight after being planted out. Where a large plantation for timber is intended, the ground after being two or three times ploughed in order fully to destroy the weeds, furrows should be made about six feet distant from each other, in which the nuts may be deposited about ten inches apart, covering them well with earth, and keeping them perfectly clear from weeds, by means of hand and horse-hoeing, care being taken not to injure the bark of the young plants. While they are very young and small, perhaps digging the ground between the plants may be the most advisable method. In these cases, where the nuts answer well, they must be thinned out at the seasons just mentioned, till they stand at about three feet in the rows; at which distance they may remain for three or four years more, when every other tree should be removed, to make room for the remaining ones, which will reduce the whole plantation to six feet square, which will be sufficient for them, till they are large enough for poles, when every other tree may be cut within a foot of the ground, in order to make stools for poles, which, in eight or ten years time, may be strong enough for making hoops, hop-poles, &c. for which purposes they are preferable to most other trees; so that every tenth year there will be a fresh crop, which will pay the rent of the land, and all other incidental charges, and, at the same time, a full crop of growing timber left upon the ground.

It is observed by Mr. Miller, that chesnut-trees were formerly much cultivated in England, and produced good profit to the planters; as the wood of them is equal in value to the best oak, and, for many purposes, better; particularly for making vessels to hold different kinds of liquors, having the property, when once thoroughly seasoned, of maintaining its bulk constantly; and not being, like other timber, apt either to shrink or swell; hence all the large casks, tuns, &c. for wines in Italy, are made of this sort of timber, as being preferred by the inhabitants to any other whatsoever. It is also very valuable for pipes to convey water under ground, as enduring longer than elm, or perhaps any other wood. In the above-mentioned country it is planted for coppice-wood, and is much cultivated in stools, to make stakes for supporting vines, as it will endure many years, nearly double the length of time any other wood will do.

It is observed by Mr. Kent, in a letter to the Society for the Encouragement of Arts, Manufactures, and Commerce, inserted in the Appendix to the Agricultural Report of Norfolk, that observation and experience have long convinced him, that the Spanish chesnut is the most profitable tree that can be planted. That, for hop-poles and stakes it has no equal, in point of durability, and consequently no underwood can be applied to those purposes with equal profit. That it is not so quick in its growth as ash upon a moist soil; but upon a sand or loam, he apprehends, it will keep full pace with the ash, and attain sufficient size for hop-poles in fourteen years, and be worth at that age two guineas a hundred, and last, with proper care, twenty years; whilst ash, which seldom comes to sufficient size in less than twenty years, will only bear two-thirds of

the price, and decay in half the time. For gates and hurdles, it is equally good; and being less heavy than oak, is another great recommendation to it, as it is removed from one place to another with greater ease. To these and many other purposes, chesnut, trained and cut as underwood, is peculiarly adapted; and, in point of beauty, no wood surpasses it, as it admits of close planting, runs straight in its branches, and always appears florid and healthy.

He next considers the value of the Spanish chesnut for timber, in which (except for the unrivalled purposes of ship-building) it will be found for most uses equal to the oak, and in buildings and out-door work, he thinks, much superior. In 1676, an ancestor of the present Mr. Windham, of Felbrigg, in Norfolk, had, he says, the merit of being a considerable planter of chesnut. In the space of fifty years, it is presumed, these plantations required thinning, as his successor, about that time, began to apply this timber to useful purposes upon his estate. The first account is of the branch or limb of a chesnut about thirteen inches square, which, in the year 1726, was put down as a hanging-post for a gate, and carried the gate, without alteration, fifty-two years, when, upon altering the inclosures of the farm where it stood; it was taken up, under his direction, and, appearing to be perfectly sound, was put down for a clapping-post in another place. In 1743, a large barn was built with some of this timber, and is now as sound in every part, beams, principals, and spars, as when first the barn was built: about the same time, several chesnut posts and rails were put down, which he has since seen removed, and, after standing thirty or forty years, generally appeared so sound, as to admit of being set up in some other place.

The last instance which he mentions, though not of long date, will show, he supposes, the great superiority of this timber over oak in fences. In the year 1772, the present Mr. Windham made a large plantation in his park, which was fenced with posts and rails, converted from young oaks and chesnuts of the same age and scantling, such as were picked out of a place where they stood too thick. Afterwards, upon Mr. Windham's enlarging his plantation, it was necessary to remove this fence, when the chesnut posts were found as sound as when they were first put down; but the oak were so much wasted, just below the surface of the ground, that they could not be used for the same purposes again, without the assistance of a spur to support them. To these modern proofs of the utility and durability of this kind of timber, he joins the authority of Evelyn, an author of established reputation, who asserts, it is good for mill-timber and water-work, and that great part of our ancient houses in the city of London were built with it, and that it does well for table and other furniture. But as a candid quoter of Evelyn, he however admits that he says, in another place, that he cannot celebrate this tree for its sincerity, it being found (contrary to oak) that it will make a fair show outwardly, when it is all decayed and rotten within; but that this is in some sort recompensed, for the beams have the property of being somewhat brittle, of crackling, and giving warning of danger. To account for this drawback in Mr. Evelyn's opinion, it is observed, that this certainly is the case with old chesnut that has been suffered to stand beyond the time of its attaining its full growth; it is then the worst of all timber, being more brittle and more apt to crack, and fly into splinters, than any other: but he has never known this to be the case with young chesnut, and, therefore, in point of œconomy, it should never be suffered to stand longer than the points of the branches, and the complexion of the bark, indicate it to be in a growing or healthy state, which is not very difficult to ascertain, by a person accustomed to make observations upon timber; and it is this very circumstance, when properly attended to, that makes this timber more profitable than most others; for it is so early useful, that if it be cut when it squares only six inches, it will be as durable as an oak of six times its size and age. This is in a great measure accounted for, by its having so little sap in proportion to other trees, as it will seldom exceed in thickness the breadth of the bark; whereas the sap of an oak will often be from an inch to two inches thick, which is not only useless, but, if suffered to remain, tends very much to the destruction of the timber: in other respects, the duration of the chesnut may be accounted for, from its being less affected by worms or insects than other timber; otherwise it would be impossible, he thinks, that such roofs as King's College, Cambridge, built in the reign of Henry VI. with chesnut, and many other equally ancient buildings, should have lasted so long, and be still in such a perfect state as many of them are. He therefore earnestly wishes to see the culture of this most valuable plant extended over every part of the kingdom, as it must prove highly beneficial to the public. But, says he, let no one be afraid of cutting it too young; for, let this tree be ever so small, if it is large enough for the purpose for which it is wanted, it will be the less liable to decay from its youth; and, if underwood be the object, the proverb, in beech countries, will be fully verified, "Cut wood and have wood."

Dwarf-Chesnut, a tree of the same kind, which grows to about eight or ten feet high. The stem is of a brown colour, and divides into several branches near the top. The leaves are of an oval, spear-shaped figure, acutely serrated, with a hoary cast on their under side. The flowers come out in the spring, in slender knotted catkins: they are of a greenish yellow colour, and are very seldom succeeded by ripe seeds in England. This tree is hardy, and thrives best in a moist soil and shady situation. The method of propagating it is from seeds, which we receive from America. These should be planted in drills, as soon as they arrive, in a moistish bed of rich garden mould. If the seeds are good, they will come up pretty soon in the spring. After they appear, they will require no trouble, except keeping them clean from weeds, and watering them in dry

weather. They may stand in the seed-bed two years, and be afterwards planted in the nursery-ground at a foot asunder, and two feet distance in the rows; and here, when they are got strong plants, they will be fit for any purpose that may be required.

Horse-Chesnut, a large, well-looking, deciduous tree; growing to seventy or eighty feet high, and throwing out its branches to a considerable width; yet forming a close thickset head; which, if left to nature, takes a most beautifully striking, parabolic form. Its leaves are large, palmated, and of a dark green colour: they appear very early in the spring; their buds sometimes beginning to swell so early as Christmas. Its flowers are singularly beautiful, standing in large spikes thick among the leaves. This tree is peculiar in a quick formation of its shoots, which are frequently perfected in less than three weeks from the time of foliation; in which time, Miller observes, he has measured shoots a foot and a half long with their leaves fully expanded. For single trees, the horse-chesnut stands amongst the first of the ornamental tribe; and in the spring of the year, when its flowers are out, we know no tree equal to it in beauty. It is improper, however, to be planted near gardens or kept walks, as it sheds its leaves early in autumn, and, being large and numerous, they create a disagreeable litter. The uses of this tree are few: its timber is of an inferior kind, and its fruit of no great estimation: deer are said to affect it much; and the author just mentioned says, in Turkey the nuts of this tree are ground and mixed with the provender for their horses, especially those which are troubled with coughs or are broken-winded, in both which disorders they are accounted very good. Hanbury also observes, that swine will fatten upon them: but does not say how they are to be prepared. We have known them offered to hogs raw, also boiled, as likewise baked in an oven, but without success. The horse-chesnut is propagated from the nuts: In autumn, therefore, when they fall, a sufficient quantity should be gathered. These should be sown soon afterwards in drills, about two inches asunder. If the nuts are kept till spring, many of them will be faulty; but where the seminary ground cannot be got ready before, and they are kept so long, it may be proper to put them in water, to try their goodness. In the spring, the plants will come up; and, when they have stood one year, they may be taken up, their tap-roots shortened, and afterwards planted in the nursery. When they are of sufficient size to be planted out finally, they must be taken out of the nursery with care, the great side shoots and the bruised parts of the roots should be taken off, and then planted in large holes level with the surface of the ground, at the top of their roots: the fibres being all spread and lapped in the fine mould, and the turf also worked to the bottom. A stake should be placed to keep them safe from the winds, and they must be fenced from the cattle till they are of sufficient size to defend themselves. The best season for all this work is October. After the trees are planted, neither knife nor hatchet should come near them; but they should be left to nature to form their beautiful parabolic heads, and assume their utmost beauty. The horse-chesnut, like most other trees, delights in good rich land; but it will grow exceedingly well on clayey and marley grounds. It prefers a moist situation. Miller observes, that when these trees are transplanted, their roots should be preserved as entire as possible, for they do not succeed well when torn or cut; nor should any of the branches be shortened, for there is scarce any tree which will not bear amputation better than this; so that when any branches are by accident broken, they should be cut off close to the stem, that the wound may heal over.

CHEST, the breast, or that part of an animal's body which contains the heart, lungs, &c.

Chest-*Founder*, in *farriery*, a disease incident to horses, which proceeds from inflammation about the chest and ribs. It is shown by the symptoms of stiffness of the body, shoulders, and fore-legs, and sometimes by a short, dry cough attending them, with a shrinking in the animal, on being handled in these parts. The method of cure in these cases is by means of bleeding and purging, according to the extent of the inflammation, and by the use of soft, attenuating, pectoral drinks. The external parts may be occasionally bathed with some discutient application, such as those of the saturnine and camphorated kinds. These inflammations sometimes terminate in abscesses about the shoulders or the fore-legs, and in that way remove the disorder.

CHEWING-*Ball*, in *farriery*, the name of a medicine in the form of balls, adapted to restore lost appetite in horses.

Balls of this kind are made in the following manner: take of assafœtida and liver of antimony each a pound; of the wood of bay-tree, half a pound; of juniper-wood an equal quantity; and of pellitory of Spain two ounces: pound the ingredients apart into a gross powder, in order to which the woods must be previously well dried. Then put them altogether into a mortar, and incorporate them with a sufficient quantity of good verjuice, well clarified, pouring it in by degrees, till the whole is reduced to an uniform mass. Make the mass into balls of about an ounce and a half each. Wrap one of these balls in a linen cloth, and fasten it by means of a string in the horse's mouth, making him chew it for two hours in the morning, and the same at night, continuing the method till he recovers his appetite. After one ball is consumed, another should be put in. They may be used on the road, in travelling, being fastened to the bit of the bridle.

Chewing *the Cud*, the operation of re-chewing the food in ruminant animals, as the cow, sheep, &c. by this means, the food is more effectually broken down, and mixed with the saliva of the animals.

CHICKEN, the young of the hen kind. See *Poultry*.

CHICKWEED, a low creeping weed, of which there are several varieties. It flowers and seeds early in the spring, and, if it be suffered to grow, several times in the course of the year. The best way to destroy it is therefore to pluck it up from time to

time, before it can shed its seed. The berry-bearing sort, which grows with smooth erect stalks, globular empalements, and the stamina longer than the petals, is the wild lychnis, or white behen, and is a very rambling weed, natural to most parts of England, frequently called spatling-poppy. Its roots are perennial, and strike so deep into the earth, that they are not easily destroyed by the plough; for which reason, bunches of this plant are too common among corn, in land which has not been perfectly well tilled. Summer-fallowing, and carefully harrowing out the roots, which should then be burnt, is here the best and most effectual remedy.

It is also the name of an annual weed, called by botanists *alsine*, which, though it perish every year, will soon become very troublesome, if suffered to stand till it sheds its seeds; particular care should be taken to prevent the seeding of this plant upon dunghills, where it is often suffered to grow unnoticed and undisturbed: for its seeds scattered there, and intermixed with the dung, may soon give birth to a multitude of weeds in the land upon which it is spread.

CHICLING-*Vetch*, a perennial plant, growing naturally in many places, commonly termed everlasting-pea. See *Vetch*.

CHICORY, a plant of the endive kind, which has been recommended for cultivation, as a green food for sheep and cattle. Where it takes, it will produce abundance of food, and may be cultivated with but little trouble, as it is not particular in respect to soil: in the drill-method, it might probably be grown to much advantage. It has been asserted to be capable of being made into good hay. It has been introduced by the Latin title of *Chicorium Intibus*. The seed, introduced by Mr. Young, was obtained in France, but the plant is a native of this country, and grows wild in most parts of it. The usual mode of culture, is to sow it with spring-corn, either with or without clover, or other grasses: when sown by itself, the quantity is generally ten pounds of seed per acre. It has been asserted to succeed much better with sheep and pigs than with the larger kinds of cattle. It will thrive on almost any soil, if it comes up; but it has frequently been found to fail in this respect, probably from a defect in the vegetative power of the seed.

According to a late writer, this is a plant which "seems to have been first fully brought to the notice of agricultors, by the various experiments and observations of Mr. Young, detailed in his useful work, the Annals of Agriculture." It is a plant which is supposed, by professor J. Martyn, in his edition of Miller's Dictionary, to be an highly improved variety of common succory, as, in its wild state, that plant is dry, hard, and without much succulence. It has been observed, that it "is capable of being grown on most of the loamy descriptions of soils, and even in some of the more light brashy sorts of lands, and the poorer kinds, especially the sandy sorts; but succeeds the most perfectly in such as are not too much retentive of moisture."

Mr. Young remarks, that it is of such consequence for different purposes of the farm, that, on various sorts of soil, the farmer cannot, without its use, make the greatest possible profit. Where it is intended to lay a field to grass, for three, four, or six years, in order to rest the land, or to increase the quantity of sheep-food, there cannot, he thinks, be any hesitation in using it There is no plant to rival it. "Lucerne, says he, demands a rich soil, and will always be kept as long as it is productive; but, upon inferior land, it is not an equal object. Upon blowing sands, or upon any soil that is weak and poor, and wants rest, there is no plant, he supposes, that equals this." On such sort of blowing poor sandy lands, "as many districts abound with, especially in Norfolk and Suffolk, it will yield a greater quantity of sheep-food, than any other grass at present in cultivation. On fen and bog-lands, and peat-soils, it also thrives to much profit. On all land, whatever the soil, on which clover, from having been too often repeated, is apt to fail, chicory may be substituted to great advantage. It does very well for soiling cattle, both lean and fattening. It is of excellent use for those who keep large stocks of swine: and it does exceedingly well in an alternate system of grass and tillage, as it will last four, five, six, and even more years; but it should not be sown with any view of making hay, in this climate, though it forms a considerable proportion of many of the best meadows in the south of France and in Lombardy."

It has, however, he adds, been objected to, on the grounds of "its rising and becoming a vivacious weed in succeeding crops." And, "if this circumstance be not guarded against, this will, he says, happen; but not more, or so much, as with lucerne. But who, he asks, ventures to forbid that culture, on account of this quality, which is really founded on its merit? When the land is ploughed only, says he, use a broad sharp share, and harrow in tares for feeding or soiling, or breaking it up for turnips, and there is an end of the objection."

It is remarked, in respect to the preparation of the land, that "it is, probably, less particular than many other similar plants, but answers in the best manner where the land is in a tolerable state of fertility, and has been rendered, in some degree, fine and mellow. When it is put in with other sorts of crops, it is obvious the same sort of preparation must be employed; but when sown alone, the ground should be rendered fine by two or more ploughings, at suitable seasons, according to the nature of the soil, and repeated harrowings."

In respect to the seed, it "is best collected from the plants by the cultivator, as this, like most other sorts, is liable to be mixed in the shops. It vegetates in the most perfect manner when new.

"The quantity which is necessary for the acre, must, as in other sorts, of course vary, according to the nature of the land, and the intentions of the farmer; but the usual proportion, whether sown alone or with grain, in the spring, is from ten to twelve pounds. In the row-method of sowing, seven or eight pounds may, however, be fully sufficient.

As the plant is not of the tillering or spreading sort, a full proportion of seed should, however, be constantly put in, that the ground may be well covered with herbage."

In regard to the period of sowing or putting in crops of this sort, it must be regulated by the method in which the business is performed, and the views of the cultivator. "Where it is sown without other sorts of crops, the work may, it is observed, be executed at any time, from about the middle of March till the latter end of the summer; but, with corn, it must depend on the season they are put in. It is sown with both oats and barley, but the first will obviously admit of the more early sowing. From the plant being hardy, it should probably be put into the soil as early in the spring as possible. Mr. Young found it less liable to be injured by grain-crops, than any other sorts of grasses; and to succeed well with most of them." April is probably the best season with spring-corn.

It is mostly sown in the broad-cast method, after the surface has been rendered fine, and covered in by a light harrowing. But, from its growing with the greatest luxuriance where it is the most open, and has the greatest benefit of free air, it is suggested as well adapted to the row-method of cultivation, or that of the drill. Where the broad-cast plan is followed, twelve pounds of seed should be sown to the acre; but when drilled in, at a foot distance in the rows, over broad-cast or drilled corn, nine or ten pounds may be fully sufficient. Care should likewise be taken, in whatever way the sowing is performed, to have new seed, as the old seldom vegetates well, and is liable to be mixed, if not collected by the farmer himself.

Where crops have been put into the ground in this manner, little attention becomes necessary afterwards, especially when cultivated in the common broad-cast method; but where drilled in rows, the use of the hoe will be required, to keep the intervals, as well as the plants in the rows, clear, and the ground well stirred about them.

Crops of this sort of plants, from the great quickness and luxuriance of their growth, are capable of being repeatedly cut, according to the author of Practical Agriculture, in the summer months, for the purpose of soiling horses and other sorts of stock. They should not, however, be cut more than once or twice the first season; but in the following summers, the operation may be performed three or four times, according to circumstances. Mr. Young, he says, advises four cuttings, in order to prevent the stems from running up too much, and becoming dry, sticky, and less nutritive. The proper times are, to begin about April or May, and to continue it every other month till October.

The produce, when cut green, in Mr. Young's trials, afforded, upon the average of four years, thirty tons to the acre. This is, probably, however, a larger produce than the plant is capable in general of affording.

It is only in very favourable seasons that this coarse juicy plant can be made into hay with success; nor is it well suited to the purpose, being of greater advantage when consumed in its green state. Its produce in this way is stated at from three to four tons per acre, by Mr. Young, in his Annals. This sort of hay is, however, asserted to be nutritious.

When left to run up to stem and seed, the produce is considerable, amounting, in the third year, to more than four hundred weight on the acre.

The great motives for sowing this sort of crop are, that, on poor sandy soils, when sown with a portion of cocksfoot-grass and burnet, it will form a layer, Mr. Young says, for six or seven years, "far exceeding those formed with trefoil, white clover, and ray-grass, which are the plants usually had recourse to, and will support so many sheep as very materially to improve the soil. This is one capital motive for cultivating chicory. Another is, for the application of the produce, on better land, to soiling horses, oxen, cows, and all sorts of cattle, for which use three years are the proper duration. A third use is, for feeding in the field, or soiling hogs, for which purpose it is very advantageous. These are, he thinks, objects so important in themselves, as to plead powerfully in its favour. Objections to it have been made, by reason of its rising, and becoming a vivacious weed, in succeeding crops, as have been seen above." And "if the circumstance be not guarded against, this will happen."

According to Dr. Dickson, "the most useful application of this sort of crop, is, probably, that of feeding of cows, and other sorts of cattle, and the soiling of these, as well as horses; as it springs more rapidly than either saintfoin or burnet: but it is likewise found to answer admirably for pasturage for sheep, as it is less injured by close-feeding than many other plants."

It has been stated, by Mr. Young, that "in a comparative experiment made on a small piece of land, of a wet, sandy, friable, loamy soil, marley bottom, drained.—On a cabbage preparation, sowed oats with chicory, and various other seeds: the oats were mown at harvest, but had only been used as the means of laying down: in May, when the grasses were mown and weighed green, those with chicory were the most productive. No rain fell till 11th and 12th July, when it was very heavy; on the 14th of this month, cut the chicory crop; the others had not any thing worth mowing. In August, cut all again, when the chicory crop had much the advantage in quantity. In the after-grasses, also, the chicory was the only one productive." On this, the author of Practical Agriculture remarks, that, "from the whole of the experiment, it appears that the superiority of chicory in general, over other plants in general, is very considerable, which is a circumstance principally to be attended to." And that, "as a large proportion of green food is afforded by this plant, at a period when it is not otherwise easily obtained, its uses, in soiling cattle or other animals, is evident."

"In a comparative experiment of stall-feeding eight beasts, with tares and chicory, it appears, Mr. Young says, that, on putting to tares only from May 25th to June 21st, they gained $49\frac{1}{2}$ stones; weighed again

6th July, gained 17 stones: on this weighing, they were put to chicory, the tares and that being both given to them: weighed again the 13th July, only one week afterwards, and had gained $27\frac{1}{2}$ stones, or an advantage of about 8*s.* 7*d.* per head per week." And "its utility for the purpose of pasturage is fully shown, he says, by other statements; as from an experiment made with ten pounds of this seed, over five acres, on a good, strong, wet, loamy soil, sown with barley, among clover, trefoil, rib-grass, burnet, &c. in order to remark in the pasturing whether sheep and cattle would eat it as well as those other grasses; it was viewed during part of three years, particularly in the autumn, after the barley was cut, when a fine fleece of herbage was produced; the two following years, it was mown the former, and fed through the latter. It proved by the result, that the chicory was always eaten by sheep, cows, and fattening bullocks, as close to the ground as any other plant. Though horses were in the field, no remark was made whether it was eaten by them; but in stable soiling they eat it with avidity."

In one of the more northern districts, as stated in the Annals of Agriculture, "Mr. Martin found it an excellent summer pasturage for store-sheep, whether mixed with clover or alone, especially on dry soils, and in dry summers; as, from its tap-root, it receives nourishment from a great depth, affords a large quantity of food, and bears eating close without any danger of drought affecting it; it should always be eaten close. It may be improper, he says, in feeding-pastures, as fat cattle must have abundance of food; in which case it would send up the seed stalks too much, and they would not eat it; and by its luxuriant growth it might damage the finer grasses." And "on a brashy soil, the late Duke of Bedford found that an acre sown with this seed, the first year's produce supported seven new Leicester sheep, of about 22lb. a quarter, for six months; and was of opinion, that, on the same land, no other artificial grass would have equalled it."

These facts sufficiently show that more attention should be paid to the culture of this sort of crop, on particular soils and situations, than has been hitherto the case.

CHINE, in *horsemanship*, the back-bone, or ridge of the back of a horse or other animal.

CHISLEY-*Land*, a sort of land of a middle kind, between sandy and clayey, but which contains a large admixture of small pebbles or gravel.

CHISSUM, a term used provincially for to put forth roots or grow. Thus, to chissum is, to put forth roots or grow.

CHITT, a word used provincially to sprout out, or to grow.

CHITTED, a word used to signify sprouted, shot out, grown.

CHIZZLE, the bran or husky parts of ground wheat.

CHOCCY, a term used provincially to signify the same with chalky, resembling chalk, mixed with chalk, or of the nature of chalk.

CHOLIC. See *Gripes*.

CHOP, in *farriery*, a disease in the bars of a horse's mouth, proceeding from inflammation, which may frequently be prevented by means of discutient washes, such as vinegar, wine-lees, &c. or where the inflammation is great, by the use of the lancet. It also signifies a kind of ulceration about the pastern, occasioned by a sharp corroding humor. See *Cracks in the Heels*.

CHURCH-*Lands*, such lands as belong to, and are held under, religious establishments. It is observed by Mr. Donaldson, that lands held by corporations, whether civil or religious, experience has proved, are in scarcely any instance managed in such a way as to insure their permanent improvement. Glebe or church-lands, the writer of the Report of the County of Lancaster also remarks, or any other appropriated to the support of meeting-houses, and those lands which appertain to small livings, purchased by the bounty of Queen Anne, are generally under a bad state of cultivation; the uncertainty of lease, depending on a contingency of a single life, operating as strong obstacles to any degree of even moderate improvements; and in consequence they are in general under the very worst sort of management. This account of the management of church-lands, the author we have first mentioned says, is strictly true, when applied to other parts of England, as well as to the county of Lancaster. This in some degree proceeds from the want of some proper regulations in respect to the tythes. See *Tythes*.

It is also further noticed by the same writer, that the modes of leasing lands, either for a term of twenty-one years, renewable on payment of a fine at the end of every seven, or on one or two lives renewable on the demise of one of the persons named in the lease, on the payment also of an arbitrary fine, as practised by the dignitaries of the church of England, are well known to operate powerfully against the improvement of church-lands. It is impossible, says he, it should be otherwise; for who, in his senses, will think of expending money on the improvement of land, when these very improvements are to operate against himself at the renewal of a lease; which in the one case is limited to seven years, and in the other is held on a very precarious tenure? Such regulations, in regard to leasing church-lands, ought, he thinks, to be made as would leave the tenants at liberty, to expend part of their capitals in the improvements of their farms, without being compelled to pay a ransom at the end of every seven years for the improvements which their own money, labour, and industry, have effected in the intervals.

That some regulations are necessary in respect to lands of this tenure is extremely obvious, from the bad state of cultivation in which they for the most part appear in.

CHURN, the name of a vessel in which cream is coagulated by agitation. There are many different constructions or sorts of churns; but that which is called the upright or Dutch churn, and the barrel churn, are by much the most generally employed.

In Cheshire, Mr. Wedge remarks, that the churns in common use are of the upright sort, and have in some cases a lever applied to them; in which case one end of it, which is supported by an upright frame, is connected to the end of the churn-staff, and the other end of it by means of a rod, to the crank of a toothed wheel, and this is wrought by a pinion fixed upon the axis of a common winch. By this simple contrivance, the operation of churning is performed by a single person with the greatest ease and facility.

In large dairies, churns are frequently wrought by means of a horse; and on such farms as have threshing-mills, they may be very conveniently attached to, and wrought by them. But in whatever way the business of churning may be performed, the size of the churn should always be suited to the quantity of cream intended to be churned, as without attending to this point, much loss may frequently be incurred by the cream being forced out of the churn, as well as other causes.

The common churn is represented in *pl.* XVIII. *figs.* 2 and 3; where *fig.* 2. is the handle or staff; and *fig.* 3. the body of the churn. The lower end of the staff is placed in the body of the churn, and being raised with a pretty quick motion by the hand on the upper part of the staff, the cream in the body is agitated, and by that means coagulated into butter.

Figs. 4, 5, 6, 7, represents the several parts of the barrel-churn. *Fig.* 4. is the arbor or part in which the beaters are placed. *Fig.* 5. its bung or cover. *Fig.* 6. the body of the churn; and *fig.* 7. the stand on which it is placed. The arbor cannot be taken out of the body of the barrel-churn without the aid of the cooper; but is here represented by itself, to show the manner in which it is made. In *fig.* 6. the churn is represented with the arbor on it, but not placed on its stand in order to show the latter. When the utensil is to be used, the churn is placed upon its stand, the cream poured into it through the bung-hole, and the hole closed with its bung. The arbor is then turned round pretty fast, by which the four leaves of the arbor agitate the cream, and coagulate it into butter.

Another churn of the upright kind, on an improved principle, has lately been constructed by Mr. Rawntree. It is represented at *fig.* 8. See *Dairy* and *Butter.*

CHURNING, the operation of procuring butter, by agitating cream in a churn. It has been suggested by some, that this operation might be expedited by the addition of acids, such as distilled vinegar, towards the close of the process. It is probable, however, that this cannot be done in any way without much injury to the produce of the operation.

CIDER. See *Cyder.*

CLAP, *in the Back Sinew,* in *farriery,* a disease in horses. See *Back Sinew-strain.*

CLASPERS, the threads or tendrils of creeping plants.

CLAVER, a provincial word used in some counties for clover. See *Clover.*

CLAW, the foot of a beast or bird armed with sharp nails.

CLAY, a soft, unctuous, and tenacious earthy substance, which is found in a native state, in many places. If it be mixed with water, Dr. Fordyce observes, that it forms a tenacious mass, which hardens upon drying, and does not diffuse so readily in water again as sand. If a mass of it be heated red hot, it becomes hard, and burns into a brick, and resembles in its properties crystalline earth. Soap-earth agrees in its properties with clay, of which it is a species, only it is much more diffusible in water, separates from it with greater difficulty, and is of a smoother texture and finer particles. By culture, clay becomes more diffusible in water. The earth consists principally of strata of substances, in which the clay and crystalline earth are sometimes found pure, but more commonly there is a mixture of the two; and we seldomer find pure clay than pure sand.

It is remarked by Lord Dundonald, that this kind of matter forms not only a large portion of the surface soil of most countries, but is also found in the mineral strata, to an immense depth; that argillaceous matter, or clay, is no where found pure, but is more or less adulterated with the different earths, and with different materials; such as mineral, vegetable, and animal substances. The purest clay contains upwards of sixty per cent. of siliceous matter, or sand.

Clay is the earth most retentive of moisture, by which it becomes ductile and tenacious; and loses these properties by the action of fire.

Clay, Mr. Kirwin says, is of various colours; for we meet with white, grey, brownish red, brownish black, yellow or blueish clays: it feels smooth, and somewhat unctuous: if moist, it adheres to the fingers; and if sufficiently so, it becomes tough and ductile. If dry, it adheres more or less to the tongue: if thrown into water, it gradually diffuses itself through it, and slowly separates from it. It does not usually effervesce with acids, unless a strong heat be applied, or that it contains a few calcareous particles, or magnesia. It consists of argill and fine sand, usually of the siliceous kind, in various proportions, and more or less ferrugineous matter. The argill according to him forms generally from 20 to 75 per cwt. of the whole mass; the sand and calx of iron the remainder. These are perfectly separable by boiling in strong vitriolic acid. See *Argillaceous Earth* and *Alumine.*

It is observed by the author of Phytologia, that the too great adhesion of the particles of argillaceous earth or clay renders it, in its pure state, unfit for vegetation; as the tender fibrils of roots can with difficulty penetrate it, whence it becomes much improved for the purposes of agriculture, when it is mixed with calcareous earth and with siliceous sand, as in marl. It is commonly believed, he also remarks, that lumps of clay become meliorated by being exposed to frost in its moist state, which, by expanding the water which it contains, by converting it into ice, is supposed to leave the particles of the clay further from each other. This however, he says, seems in

general to be a mistaken idea, since, if the act of freezing be not very suddenly performed, a contrary effect seems to occur, as noticed by Mr. Kirwan in his Mineralogy, vol. I. p. 9. who observes, that clay in its usual state of dryness can absorb two and a half times its weight of water without suffering any to drop out, and retains it in the open air more pertinaciously than other earths; but that in freezing, cold clay contracts more than other earths, squeezing out its water, and thus parting with more of it than other earths. This curious circumstance, that water, as it crystallizes, detrudes the clay, which is diffused in it, corresponds, he remarks, with other facts of congelation. Thus when wine, or vinegar, or common salt and water, or a solution of blue vitriol in water, are thus exposed to frosty air, the alcohol, the acetous acid, the marine salt, and the calx of copper, are all of them detruded from the aqueous crystals, and retreat to the central part of the fluid, or to that last frozen, or into numerous cells surrounded with partitions of ice, as he has frequently observed; whence it appears, that wet clay is in general rendered more solid and tenacious by being frozen, as well as when it is dried, and its moisture exhaled by too warm a sun; and by both those circumstances becomes less adapted to the purposes of agriculture. In most clays, a kind of effervescence occurs, after they are turned over, and thrown on heaps, and thus acquire air into their interstices, which renders them much fitter for the purposes of vitrification, and thus forwards the processes of the brick-kiln and pottery. This greater facility to vitrify is probably effected by the union of oxygen with the iron, which most clays contain; as oxydes of lead and manganese are used in the more perfect vitrifications. When the clay abounds with vitriolic acid, so as to be converted into alum, it becomes very unfriendly to vegetation.

Vast improvement in many of the lighter sorts of soil are effected by the use or application of clay upon them. Mr. Rodwell has found great improvement from it on the poorer sorts of sandy soils, which are very loose, and even on black sands.

And Mr. Young remarks, in speaking of marl, that when that substance "is not to be had, clay, in many places, is to be found at a moderate depth. This manure has, says he, few of the properties by which marl is to be known; but yet it works wonderful improvements on many soils. In some light lands it has been preferred by many very good farmers to indifferent sorts of marl; and this preference has been the result of attentive experience. But, continues he, the great point concerning clay is not so much the comparison with marl, as the use of it where no marl is to be had. On all light sandy soils, it should be used with a confidence of success; for the precedents of its good effects are so numerous, that we cannot have a doubt of its excellence. About sixty or seventy loads an acre, at the same expense as of marl, will work an improvement great enough to shew how much mistaken those men are, who think nothing but the finest marls worthy of attention; and upon heavier soils, such as wet loams, brick-earths upon clay, and loose hollow soils, that want a firmer texture, clay is an excellent manure; but there are vast tracts of such land, that cover very fine veins of clay, and yet the farmers know nothing of the use of it. It is much to be regretted, he thinks, that their landlords do not give them a juster idea, by being at the expense of claying some small fields, until the benefit of the improvement becomes conspicuous."

Clay-*Farms*, such farms as have the lands principally of the clayey kind. See *Farm*.

CLAYEY, mixed with clay, partaking of the nature of clay.

Clayey-*Land*, that sort of ground or soil in which clay is, in some degree or other, predominant. Lands of this kind are various, according to the proportion of the clayey material they contain. According to the observations of the able author of the Treatise on the Connection of Agriculture with Chemistry, there is no clayey land or soil that is pure and free from sand; and there are but few clays that are free from a mixture of calcareous matter, magnesia, vegetable and animal matters, mineral oil, and other mineral or metallic substances: some clays are of a much more unctuous, and, as it were, greasy nature, than others. They do not differ more in this respect than they do in the appearance they assume when submitted to a moderate degree of heat. Those clays which are the most unctuous and greasy to the touch are by calcination changed to a black colour. This must be owing either to their containing animal or vegetable matter, although, previous to calcination, it escapes observation; or the inflammable matter in the clay may exist in the state of a colourless mineral oil, adhering obstinately to the clay, and not capable of being separated from it by water, with which oil can hold no union: yet capable of being changed into a black carbonaceous matter by the action of fire. A due mixture of clay serves the important purposes of retaining in the soil the attenuated vegetable and animal substances, as also the mineral oil. Of this description are those clays, or clayey loams, which have been deposited by the sea or muddy streams, containing a considerable proportion of the exuviæ, or remains of animal and vegetable bodies, in an extreme degree of attenuation. Such lands as these are the most permanently fertile, and, where the climate is favourable, produce the heaviest and best filled grain. Soils formed by depositure, for the most part, contain a sufficient quantity of calcareous matter. Adding lime to such lands may prove injurious, by its expending, taking up, or otherwise altering the arrangement and combination of the animal and vegetable matters, which should carefully be preserved for succeeding crops. Under any circumstances, lime should, he thinks, be given to such soils but sparingly. But there are clayey soils containing little or no animal, vegetable, or bituminous matter, and which are equally deficient of calcareous matter, consisting only of clay,

sand, and the earth of iron. To improve and render fertile a soil of this description is truly an Herculean task, and will seldom repay the industry of the cultivator, unless situated in the neighbourhood of a town, where more dung may be procured than can be spared from the farm in its contiguity. A soil of this nature can receive little or no benefit by the application of lime, as it contains nothing for the lime to act upon or combine with. When under such circumstances, that dung, or such like manure, cannot be procured, a preparation of peat, with a very moderate proportion of lime, seems to be the next best application. A soil of poor lean clay, such as above described, will require eight tons of lime, and forty-eight tons of peat, for one dressing. Doing things partially can never answer: this quantity is the least that ought to be applied; a much greater may be given, if the articles can be cheaply and easily procured. In this the farmer must be regulated, in a great measure, by his ability in doing, or extent of his capital. His primary object, in this case, should be to promote the growth of pasture-grasses, because the soil at first will be in no heart to produce crops of grain; and, secondly, because the promoting the growth of such grasses, and judiciously depasturing and folding, is the surest way of improving such lands. After the grass has taken hold of the ground, and is beginning to carry a tolerably thick sward, its thickness and quality may be greatly improved by some one or more of the top-dressings or preparations recommended under that article. See *Top-Dressings*.

Clayey lands are therefore as different in their natures as in their colours. Some of them are so obstinate that it is scarcely possible to subdue them. Others are so soft and unctuous, as to be easily reduced to a proper state for nourishing plants: while others again are so hungry as to absorb, in a short time, whatever kind of manure is applied, without either materially altering the nature of the soil, or improving the crops. Clay being, as has been seen, a solid compact body, and its particles adhering firmly together, it does not easily admit water, although capable of receiving a large quantity, nor does it part with it but by slow degrees. When dry, it is hard and dense: and the more rapidly water is drained off or exhaled, the harder it becomes, frequently opening into little chasms or rents, when suddenly dried. As clay, from its tenacious quality, retains water longer than any other soil, the roots of the plants, in a rainy season, are frequently soaked in water for a considerable time, and the plants themselves, if not entirely destroyed, are so chilled and weakened as to produce very indifferent crops. On the other hand, from the natural closeness of its texture, added to the circumstance of its hardening very quickly and to a great degree, when the moisture is suddenly extracted, the plants in a dry season are prevented from extending their roots in search of nutriment; while the dews, and light summer-showers, so essential to the growth of all vegetables, and which easily penetrate the more friable soils, are repelled by the clay, and again exhaled by the influence of the sun. From this description of the nature of all clay soils, it is scarcely necessary to mention the great importance of keeping them as dry as possible at all seasons, especially during winter. When that is properly attended to, the farmer has it in his power to plough and sow on the first return of favourable weather in the spring; as thereby, in a great measure, he avoids the risk of his crops suffering, either from heavy falls of rain, or a long continued season of dry weather, particularly the latter, for when a clayey soil is reduced to a proper state by the harrows and roller, after the seed is sown, it very seldom happens that the crop sustains any material injury from the want of rain during the remainder of the season. But although the nature and properties of clayey lands be such as above described, yet by industry, and the application of such manures as are best calculated for correcting their bad qualities, and for bringing those most favourable to vegetation into action, this sort of soil is often made to produce abundant crops.

Clayey lands of whatever kind, the author of the Synopsis of Husbandry says, "require a more laborious exertion to reduce them to a fineness necessary for the purpose of husbandry than any other soils, and are distinguished under various names, arising from the colour: but the intrinsic good or ill quality of this soil depends not on those vague distinctions, but on the proportion of sand intermixed with it; and where this ingredient is happily blended with the clay, and where the soil is of a reasonable depth, and the springs do not rise too near the surface, when these several good qualities are united, there are few soils more kindly for the several purposes of husbandry; and though in their cultivation the clays may require a greater strength both of horses and tackle than any others, yet, on many accounts, they deservedly claim the preference, either to a chalk, gravel, or sand. Of this kind, he observes, is the lands in the wealds of Kent and Sussex; and he knows of no part of the kingdom where the several purposes of husbandry are more effectually answered than in these counties: the size and fatness of the beasts evince the fertility of their pasture, whilst the luxuriancy of its several growths of hops and corn proclaim the superior goodness of the arable land; and the large spreading oaks are a demonstrable proof that it is kindly to the growth of timber. But there are other kinds of clayey soil which, being by nature so stiff and tenacious as not to be meliorated either by tillage or manure, bid defiance to the most skilful plan of husbandry, and can never be brought to yield a sufficient quantity of earth to heal the seed, unless in a season the most propitious; and even with every advantage that can attend it, this ground will fail to produce a crop by any means adequate to the pains and expense required in working it; so that it demands some judgment to discriminate the various kinds of clays, which, though they all rank under the same general denomination, do yet differ most essentially in their properties. Those of the more sterile kind are rarely of any considerable depth,

having a bed of gravel for the under stratum, and are generally within a near proximity to the springs; for that this kind of land being always overcharged with wet, or parched with drought, and therefore subject to accidents, which it is seldom in the power of the husbandman to foresee or prevent, is, on these accounts, inferior to most others: whilst clays of the first denomination are deservedly ranked, as has been observed, among the most fertile soils. To determine the goodness of a clayey soil, one should have recourse, he says, to the appearance of the trees, corn, and other vegetables: the prosperous growth of the trees and hedges, the flourishing state of the corn, and the verdure of the meadow-land, are favourable omens; whilst the stunted appearance of the trees, thin crops of corn, and short grass, are plain indications of the poverty of the soil."

In tilling this kind of land, the renter will act wisely, he says, in "providing himself with stout and able horses, strong ploughs, and other instruments of husbandry; and his hinds, likewise, ought to be those of the most sturdy breed. Of the many different kinds of ploughs now in use, there are none better adapted for working these stubborn grounds, than those commonly distinguished by the name of swing-ploughs: these are constructed without wheels, and the horses draw single, following each other in the furrow: in both which respects, this plough claims the preference to wheel-ploughs, where the horses, by going abreast, tread the ground much more than in the former instance; though, in Kent, the farmers usually work their stiff land with the common turn-rest, or, as it is vulgarly called, turn-rise plough, which is made far more weighty than the Hertfordshire, or any other wheel-plough; and, from the circumstance of turning the rest at the end of every furrow, is not chargeable with the defect before-mentioned, of subjecting the fresh ploughed ground to be trodden by the horses. In some counties, they till their stiff lands with a foot-plough, which, by means of the iron that is let into the beam and rests in the furrow, works with more steadiness than the swing-plough, but in the other parts of its construction, nearly resembles the last-mentioned instrument. As most of the ill qualities attending this soil originates in its adhesive nature, every art should be made use of to meliorate and pulverize the stubborn clods, so as to reduce them to that degree of fineness necessary for the purpose of vegetation."

In winter-fallowing a clayey soil, "let, says he, the ground that is proposed to be sown with oats or beans in the spring, be fallowed up as soon as possible after the wheat-season is finished, and be careful that the lands may not be made over large; perhaps five bouts or wents may be a proper size, so that each land may measure about half a rod over; but this is to be determined by the nature of the soil, and the locality of the situation. It has been shown already, that clays differ essentially from each other, and hence it seems of consequence, at the fallowing of those which are of the wet spewy kind, to lay the ridges in such manner that they may be least incommoded by the winter rains; whereas, in those of a more moderate texture, and which are less inclined to moisture, this caution is not necessary: but to guard against the contingency of moisture during the winter, by laying the land as dry as possible, is a point to be attempted by all possible means on every different description of this soil. The ground having been thus fallowed at an early season, and having partaken of the benefit of the winter's frosts, will generally work kindly towards the middle of February, which is the proper time for planting beans on clays. For oats, perhaps, three ploughings may be required, provided the season be favourable for performing them; for, in a very wet spring, it may be more prudent to dispense with one ploughing, and to sow after the first stirring in April: but if the weather be kindly, it will be advisable, when the bean-season is finished, to stir such ground as is intended for oats; and this fallow, having enjoyed the benefit of the March winds, will work well at the second stirring in April, the proper time for sowing oats on stiff lands. The ground having been thus managed, will come in for beans the next year, or be in a state of tillage proper to sow with clover, which generally succeeds well when cultivated on these soils; and the fields which were put in with beans, if the ground be in good heart, will come in for a wheat-season at the following autumn. And this shows how necessary it is for a farmer to look forward, in order that his land may not only be well prepared for the growth of the present crop, but be in readiness for the reception of a different grain in the following years."

In fallowing for wheat in a clayey soil, it has been already observed, he says, that "wheat might very properly succeed a crop of beans on these soils, a method which is generally pursued in Kent and Sussex; but where the land is of a very stiff nature, it is absolutely necessary to give it a summer-fallow once in four or five years, or oftener, according to its goodness, by which method its adhesion is destroyed, and the pores are opened for the admission of the sun, air, rain and dews, all of which abound with such principles as may contribute, in a high degree, towards the melioration and fertility of the soil. The proper time to fallow for wheat, on a clay, is in the month of April, as soon as the Lent season is finished; and, if the weather will permit, the stirring should be effected in May, and this is sometimes all that can be done to the field till after the rains in August; for, should a dry time happen in June, it will be impracticable to work the land, it having been rendered so hard as to preclude the entrance of the plough; or if this can be effected, the surface will, in this case, break up in such large clods, and withal so shallow, as to render the tillage of little worth; but should the weather permit, it will be proper to give the ground a second stirring in June, and to lay the field in ridges; for in such form the soil will more conveniently imbibe the various influences of the atmosphere, than in broader lands. The number of ploughings throughout the summer depends so much upon contingencies, that no stated rule can be laid down upon that head; for if the

weather be either too wet, or tending to the contrary extreme, the working of the more obstinate kind of clays will be wholly impracticable, and, on this account, the farmer is frequently disappointed of a wheat-season; but on clays which are less adhesive, and where the land has been conducted in a husband-like manner for a series of years, there is not so much hazard of being thrown out at the wheat-season, and a time generally offers for sowing the corn between the latter end of August and the beginning of October, which is the latest term to which the sowing of this grain ought to be protracted on these heavy lands. If the weather shall have been kindly throughout the summer, the land will have been stirred at least twice during that period; and thus with the fallowing, and the last ploughing at seed-time, the ground will have been four times ploughed, which will most probably have reduced it to a degree of fineness proper for the reception of the wheat, after which the field should be sufficiently harrowed, so as to cover the corn to a proper depth."

It is observed, by the author of the Present State of Husbandry, that "the manures most proper to be applied to these lands, are lime, chalk, sea-sand, and ashes. It appears, he says, from the accounts given by those chymists who have analized these substances, that they are admirably calculated to correct the stubborn density of clay, so as to render it more easily reducible by the plough; to open its pores, so that it may more readily imbibe and transmit water; and that they operate as a powerful stimulus, and some way or other dispose whatever principles in clayey seils are friendly to vegetation, to exert themselves. Long and established practice confirms this observation: lime, for instauce, has been applied to these soils, for many years, in the counties of Durham, Gloucester, Hereford, Montgomery, Berwick, Stirling, Perth, and many other districts where such soils prevail. Chalk is used, both in its natural and calcined states, in Hertford, Middlesex, Essex, Kent, Wilts, and other southern counties. Sea-sand is employed as a manure in Cornwall, Devon, Pembroke, Anglesey, Caernarvon, and also in several districts in Scotland. Coal-ashes, in the neighbourhood of London, are laid with astonishing success on clay-soils, whence brick-earth has been taken. Peat-ashes have produced wonderful effects in Berkshire; and ashes of both kinds are used to great advantage, as a top-dressing, on the strong soils, in all those counties where that practice is established. Besides these manures, composts, especially when formed chiefly of light sandy, or gravelly earths, with lime or chalk, are also applied to clay-soils, with success, in many parts of England. Few composts being made on the better cultivated clayey soils in Scotland, the common method is, to lay on farm-yard dung, the same season in which a field is limed; by adopting this practice, the lime is found to operate more rapidly, and, at the same time, more powerfully."

It is remarked by Lord Dundonald, that "there is a very great extent of poor clayey soil, similar to that which has been mentioned, in many parts of the North of England and in Scotland, for the most part lying at a considerable height above the level of the sea, and frequently in the vicinity of peat-mosses, whence it might be supplied with vegetable matter. In the county of Lanark, or Clydsdale, he says, there are computed to be 40,000 acres of peat-moss totally unimproved, producing nothing itself, nor contributing in any way to the fertility of the adjacent poor lands, which are as destitute of vegetable matter, as the moss contains a superabundance. It requires a much longer time, and a much greater application of dung and vegetable matters, than would be generally believed, before poor lands of this description can be rendered highly fertile, and made, in all respects, similar to land that has been long, or for ages, under cultivation. Ten times the quantity of peat, or vegetable matter, recommended to be given at once, or 480 tons, would scarcely bring poor barren land to the colour of rich black mould, known in Scotland by the name of Infield land, and to which, for ages, the dung of the farm has been exclusively applied. Experiments made with an intimate mixture of poor lean clay and peat, warrant this assertion; here purposely stated, he says, that the over-sanguine cultivator or improver of ground may not imagine, that, with a summer-fallow, and a dunging or dressing or two, he may be enabled to complete so arduous a task. Land is always requiring a supply of manure, and repays, in general, more abundantly for the last expense, when brought to an advanced state of cultivation, than for that which at first is incurred. Both seed and labour are thereby saved, and good crops, with much more certainty, are to be depended upon.

"Paring and burning the sward of some clayey soils, he thinks, may be practised with advantage, as the burnt clay will diminish the stiffness of the soil, and render it more pervious to water. This may be still more economically effected, and, in other respects, with less injury to the soil, by half burning the clay, in clamps or in kilns. A preference which can, however, only be given in situations where fuel can, at a cheap rate, be procured for this purpose." See *Burnt Clay*.

While, says Mr. Donaldson, it may be admitted, that, by the application of such manures, and proper cultivation, clayey lands are made to produce, occasionally, luxuriant crops; to every person acquainted with these soils, it must be obvious, that the crops are, upon the whole, more precarious and uncertain than those on deep fertile loams, and other similar soils.

The natural produce of clay-lands, with regard to weeds, is rushes, goose-grass, or wild tansey, large daisies, thistles, docks, May-weed, poppies, and other coarse herbage.

The following is the method of improvement of a tract of ninety-three acres of clayey land, which had remained long in an uncultivated state, in order to lay it to grass, as practised by Mr. Best, and stated in the fourth volume of Communications to the Board of Agriculture: "These lands, says he, since the memory of man, were let at £18. per annum: from

this sum they increased, owing to the advance of the times, to £22. 5*s.* which is the most they were ever let for. In the year 1788, he began on a field of eight acres, by employing some men to take up brambles, furze, and other natural incumbrances, with which two parts in three of that field were covered; in the winter he had it under-ground drained. This, he thinks, is the first step which a farmer ought to take, before he converts his land to tillage. He laid the top turf on two shoulders, about sixteen inches deep, leaving a channel open under, which got the land very dry, and so it continues. The expense of draining, when he first began, was about 30*s.* per acre, but now it is near 40*s.* In December 1790, he ploughed the whole of this field, and in the February following, spread about ten tons of well-mixed dung and earth over every acre. In April, he sowed it with flax; this is a crop that requires (particularly in strong lands, which this is, being on a strong clay, with some spots of flinty gravel), in its early part, at least twelve hours rain every week. Unfortunately for him, he had not half rain enough; consequently that crop failed. He then made as good a fallow as the nature of the land and the season would permit. At Michaelmas, 1791, he sowed it with wheat, which produced about eighteen bushels (single Winchester) per acre. As soon as the ground was cleared of the wheat, it was ploughed and sown to vetches, of which he had a great crop: he fed these off with sheep in the spring, 1793, and the ground which they cleared by day they lay on at night. After the vetches were all eaten, he made a very good fallow, and, in September, dressed it over with ten hogsheads of lime (which cost 1*s.* 6*d.* per hogshead) per acre, which he had, in the month of May, mixed with the head-lands well together. About Michaelmas, he sowed it with wheat again, and had too great a burden; for, in the month of May, 1794, he was obliged to have a man, with a keen reap-hook, to cut off all the luxuriant blades, the ear not having made its appearance. This precaution, however, did not fully answer his purpose, for a great part of the crop was thrown; notwithstanding, he had full twenty-five bushels per acre. He then made a fallow, and in the spring, 1795, sowed the field with white oats, and grass-seeds of different sorts, viz. rye-grass, cow-grass, Dutch clover, and hop. The oats were very thick and long; in consequence of which, the grass-plants in some places did not thrive, for in spots of five or six feet square there was no appearance of any. He had eight quarters of oats per acre. He fed the grass with sheep the years 1796, 1797, and till August 1798, when he again ploughed it, and dragged in some vetches. He had a great crop, and, in the spring, 1799, fed it off with sheep, folding them on the ground as they eat the vetches. When this was done, he made a fallow, as good as a wet summer would admit of, and sowed it to wheat again, at the usual season, without any additional manure, and had about twelve bushels per acre, a good crop for this year, some lands in his neighbourhood not producing more than six or seven. The acre in this county is customary measure, not statute."

It is added, that from "finding this land drained so well, he has, every winter, drained a little, as fast as he could get the land cleansed; and last winter he completed the whole ninety-three acres. He has drained a great many acres of land, besides these, and has had it done in the same manner, which answers extremely well. Twenty acres of the above ninety-three, he has kept in pasture, having, in the space of five or six years, dressed it over twice, with about fifteen tons per acre each time. His manure consists of dung, earth, soap-ashes, and the scrapings of the turnpike-roads: this latter article answers remarkably well, on a strong clay soil. The whole of these ninety-three acres are on such a soil, with some gravel. During the summer, it is necessary to turn it twice, in order that it may be well mixed; and by doing this, it is brought to a fine mould; when spread on the lands, once brushing over with some thorns makes it soon disappear. The above twenty acres are, at this time, worth 25*s.* per acre. In November, 1795, he began ploughing another piece of ground, of fourteen acres. From the manner in which this piece of ground lay, his servant could not throw it plain (it being left, the last time it was ploughed, in six-furrowed ridges), so as to bring it with any advantage to a crop in the spring. In April, 1796, he ploughed it across; after this worked it well with drags and harrows. Finding this would not do (owing to the turf not being sufficiently rotten, which he accounts for, by lying in a rough open state all the winter), he set some men to hack it over: and harrowing it well with four horses abreast, it became tolerably fine, with the exception only of the rush and sedge, of which there was a great abundance. The weather being dry, he employed twelve or fifteen women and boys beating over these rush and sedge roots, in order to get them out of the earth; some men going after them with three-pronged forks, throwing it in heaps, and burning it. By doing this, he raised a great number of ashes, which he spread over the land, and as soon as sufficiently cold, he harrowed in some turnip-seed, which came up very well; but the land being of a close stiff nature, they did not get larger than about the size of a cricket-ball; he had them hoed, otherwise they would not, in his opinion, have grown to that size. He kept 450 sheep on them, with a little hay, a month and a few days. In the month of May, previous to this, he put on the headlands 140 hogsheads of lime, which he caused to be well turned and mixed, and, as the sheep ate the turnips, this was carried and spread on the land. The latter end of October, it was sown with wheat, and produced a good crop, averaging better than twenty bushels per acre. As soon as the wheat was carried off, it was ploughed and sown to vetches (a greater burden than lands of the value of 40*s.* per acre could produce); and in the spring, 1798, fed them off with sheep, folding them by night, where they fed by day. He always makes it a point, as soon as the sheep have cleared a day's

work for the plough, to plough the land; by doing this, he preserves the manure of the sheep from the sun, and turns in what vetches were left, which, in his opinion, is equal, if not superior, to the droppings of the sheep. He has observed, that where the greatest quantity has been left and ploughed in, that part of the ground generally works much lighter, at seed-time; and that, at harvest, the wheat is superior. This may not do so well on a light sandy loam. He finished sowing this field to wheat (the second time) by Michaelmas, 1798. He was obliged, in May, to cut off all the tops of it (as he did in the other field), in order to keep it standing. When harvest came, he had sixty tithing per acre, which produced no more than 300 bushels, and about two pecks in the whole field. If the *kern* had been such as it was the year before, he should, he believes, have had thirty bushels per acre. Last year, it was sown to barley and grass-seeds. As the barley is not threshed, he cannot exactly state the quantity grown, but, from appearance, it was judged to be about twenty bushels per acre; a good crop for this country last season; the grass-plants look remarkably well, and consist of the following sorts:—rye-grass one peck, cow-grass 6lbs. Dutch clover 2lbs. cock-grass 2lbs.; this he allowed for every acre. It is customary, he says, for the tenant to be at the expense of the grass-seeds. The hop-grass did not answer in the other field; it is his opinion, that the soil is too heavy and close for it. He very much disapproves of mowing the first year after laying down, particularly on strong lands."

He further states, that, "in November, 1796, he ploughed another field, of eleven acres, and threw it very plain. As soon as it was finished ploughing, he had it rolled with a heavy roller, that it might lie as close as possible all the winter, in order to rot the *spine* or turf the better. In the early part of April, he dragged in some black oats; shortly after they were up, an easterly wind (to which this field lay quite exposed) struck them very yellow, exactly like straw, and the ground being so very poor, they never recovered it. The ground lay in this state till September, when it was ploughed across, and so it remained till the March following. The frost having opened it, and by dragging and harrowing it well, he brought it to be tolerably fine. In May, he dressed it over with 20 hogsheads of lime per acre, (which was well mixed with the headlands in April), then ploughed it as thin as possible, and sowed some turnip-seed, which came up very well, but did not flourish, owing, in his opinion, as he has before observed, to the soil being too stiff and heavy for turnips. At Michaelmas, 1798, it was sown to wheat, without any other manure. The crop produced him nineteen bushels per acre. As soon as the wheat was carried off the land, he sowed it to vetches (which, he is convinced from experience, is the best artificial sowing on strong lands), and he had a very good crop, which he fed off with sheep in the same manner as before described; and, last Michaelmas, it was sown the second time to wheat, without any additional manure; at present, it is impossible for plants to look better. He intends taking three crops from this field, as he did from the last, and then to lay it down for three years. He thinks no land should have more than three crops of corn without rest; at the same time sowing between those crops, some sort of artificials, for sheep-feed, which will keep the land clean, and in good condition. The soil will dictate to the farmer what sort of artificials to sow for his advantage. He has, at this time, another field of ten acres in fallow, which has been ploughed these twelve months. He intends pursuing exactly the same method with this, and the remaining thirty acres, as he has done with the former, and when finished, he has no doubt but that the ninety-three acres will be worth one hundred pounds per annum."

This strongly proves the vast advantage of adopting proper modes, in bringing lands of this sort into the state of good grass.

CLAYEY *Soil*, such sort of soil as consists, in a great degree, of clay. See *Soil.*

CLAYING *of Land*, the process of manuring with this sort of material, which, in many cases, is found highly advantageous, in affording a better texture and consistence to the land. It is a business that may proceed during most of the summer and autumnal months, as well as often in the winter: but it is always best applied before the winter-frosts set in, that it may thereby be broken down, and incorporate better with the soil. The modes of performing the work, are the same as for marl. See *Marling.*

CLEANING, a term applied to the secundine of the cow, ewe, &c.

CLEARING, a term applied, in threshing corn, to signify a heap large enough to be winnowed.

CLEARING *of Land*, the means of removing such obstacles and impediments as prevent or retard its cultivation and improvement. It is stated in a paper by Mr. Headrick, in the second volume of Communications to the Board of Agriculture, that the chief impediments to the cultivation of land are, 1st, stones; 2d, wood; 3d, broom, whins, furze, and brushwood; 4th, heath; and, 5th, a rough and sterile surface. And that water, either stagnant on the land, or issuing from subterraneous springs, is an effectual impediment to the cultivation or melioration of land, and must be removed before any improvement can be made. See *Draining of Land.*

It is remarked, that the stones which impede the improvement of land, and which require to be removed before it can be rendered productive, are of two kinds: 1st, loose stones, or such as are thrown up to the surface by the plough; 2d, sit-fast stones, which are either concealed under the surface, or are of such magnitude that they cannot be stirred by the plough. Where there are no concealed or fast stones in land, and this is generally the case in all washed or loamy soils, those that are thrown to the surface by ploughing and harrowing may be easily gathered and carried off. It is common, in most places, to gather all the loose stones that appear when the

land is laid down in grass, that they may not interrupt the scythe; but they are often thrown in heaps into the furrows, where they ever after continue to interrupt the plough, or are dragged again by the barrows, and scattered over the land. These stones are of considerable value to the farmer, for the purpose of making concealed drains, or for making and repairing the roads through his farm. See *Roads*.

When the land is too wet, at the time of gathering the small stones, to admit cartage, they may be laid in heaps, and be afterwards removed when it becomes dry; but in general, the best time for removing stones of every kind is during a course of fallow. A few single-horse carts, with a boy or two to lead, and a man to empty them, and a sufficient number of women and children to gather and throw the stones into the cart, will soon clear a vast extent of such stones as can be lifted by the hand. This operation should be repeated every time the land is ploughed and harrowed, until no more stones appear. There is a peculiar propriety, he thinks, in removing stones during summer-fallow, because at this time they can be removed effectually; and if concealed drains be necessary, the stones of the field may serve to construct them, and save the expense of distant cartage. If, after all, new stones are thrown up in the course of cropping, they should be removed as they appear; and the land should be effectually cleared after grass-seeds are sown, before they are rolled in. Some rollers have a hopper for receiving such stones as may appear when grass-seeds are rolled in. See *Roller*.

He asserts, that he has never heard of any but one exception to the propriety of clearing land of small stones, and which, he thinks, is mentioned by lord Kaims. In some parts of Galloway, and the south-west of Scotland, the soil is said to be composed almost wholly of gravel, and of water-worn stones, which have been thrown to the surface by the plough. The superficial stones prevent the exhalation of moisture from below, at the same time that they imbibe heat above from the solar rays; of consequence the crop pushes its roots below, and all around the upper stones, where it finds moisture, while its tender blade is made to vegetate rapidly by the heat reflected from the stones. Some farmers, who had removed the upper stones, found their crop was wholly blighted and withered in the tender blade, partly by the sun's rays, partly by the exhalation of moisture occasioned by the winds, and it never arrived to maturity. From this circumstance, they were induced carefully to replace the stones which they had formerly removed: but instead of replacing the stones, the author would have advised them to cover the whole surface of their land by a thick coat of clay marl; good earth, or loamy clay, would have been next in point of efficacy; or they might, he says, have applied a compost of bog earth and lime, of moss and lime, or of earth and lime.

Where stones are large, or are set fast in the earth, all those which appear above the surface ought to be removed before the ploughing of the waste wherein they are found is attempted. With respect to those which are concealed under the surface, various methods have been adopted. He is told that the people in Yorkshire go over the whole surface of the land, which they wish to improve, with sharp prongs; these they thrust down to the depth of about a foot, at the superficial distance of from twelve to fourteen inches, and wherever a stone meets the prong, a mark is placed. The mark is a twig, spar of wood, or any thing that can render the spot visible. They afterwards trace all the marks, and grub up every stone, before they put a plough into the land. In other places the ploughman carries a number of twigs, spars, &c. in the hollow of his plough, and whenever a stone occurs which he is unable to throw out by the plough, he plants his twig as a direction where to find the stone. He has known ploughmen, with a pair of well-trained horses, throw stones of very considerable size up to the surface, in the course of a few minutes, while they seldom or never broke their ploughs. This suggests an idea that it would be easy to contrive a machine, by the aid of which horses or oxen might speedily throw out the largest stones that are concealed under the surface of land. But where a field is excessively overrun with concealed stones, he is convinced that the cheapest and most effectual method is to delve or trench it wholly by the spade. The trenching can be done for 3*l.* to 4*l.* per Scotch acre: and, in addition, it is common to allow the quarrying price for every cart-load of stones that is turned out. Beside most effectually clearing the stones, trenching, he thinks, deepens the soil, and enables the improver to lay it in a most convenient form for cultivation. From Dr. Anderson's excellent Report of Aberdeenshire, we learn, he says, that more is done there in this way than perhaps in any other district of the island. The expense of trenching an acre to the depth of from twelve to fourteen inches, where the stones are not very large and numerous, runs from fourpence to sixpence a fall, which is from fifty-three shillings to 4*l.* per Scotch acre. Ground that has been formerly trenched is sometimes done as low as two-pence per fall, or twenty-six shillings per acre. From this it would appear, that the ground is not only trenched at first, but the stones also taken out at a lower expense than we have stated. But this only shows that, wherever a practice becomes general, workmen become expert, and reduce the price by their mutual competition. With a view to get rid of large stones, some dig a deep hole beside them, into which a stone is tumbled, and buried to the depth of more than a foot below the surface. Before the hole is dug, it is necessary first to ascertain the dimensions of the stone, as he has sometimes seen it necessary to dig another hole after a stone had been thrown into a hole too small for its reception. When the hole is so far advanced, that the workmen can get under a corner or edge of the stone, they should lay a plank across to support it, as dangerous accidents have occurred from heavy stones falling upon the men while employed in digging the hole. But where stones are wanted for

fences, or other buildings, it is necessary to blast those that are not of a portable size. To perform this properly, some experience is necessary, and a skilful workman can rend stones generally into three equal pieces without causing their fragments to fly about. This depends upon the depth and position of the bore. It is said that a small portion of quick-lime in fine powder diminishes the expense of gun-powder in blasting stones. See *Blasting*.

But it is observed, that there are a vast variety of stones which can be broken and removed without having recourse to blasting; such stones have generally some thin veins, which, being found, can be penetrated by wedges; or, by laying them upon props, they may be broken by sledge-hammers. In performing these operations, the instruments necessary are, spades, pick-axes to clear away the earth, a large and a small iron crow or lever, and a long and powerful wooden lever, shod with iron, to turn them out of the ground; a sledge-hammer is also necessary, and a smaller one with a long handle. When the stones are reduced to the size wanted, they are conveyed from the field by carts: some use slipes for this purpose, which, though they require more power to draw, do not occasion much labour in lifting the stones into them. Others again have frames of wood constructed for taking stones off their land, which run upon low broad wheels, or rollers. In some cases he has seen large hand-barrows used for conveying heavy stones, with as many handles all round as would enable a dozen or more of men to join in the work. But such an instrument is chiefly useful in conveying large stones to prop up mill-dams where horses cannot go.

In the Statistical Account of Scotland, vol. 19. p. 565. parish of Maderty, we are told, he says, that the Reverend Mr. Ramsey, the present incumbent, who occupies a piece of land full of sit-fast stones, constructed a machine for the purpose of raising them. It operates on the principles of the pulley and cylinder, or wheel and axis, and has a power as one to twenty-four. It is extremely simple, being a triangle, on two sides of which the cylinder is fixed. It can be easily wrought, and carried from place to place by three men. A low four-wheeled machine, of a strong construction, is made to go under the arms of the triangle to receive the stone when raised up. This machine has been already of great use in clearing several fields of large stones in this place and neighbourhood. But it is obvious, he thinks, that though such a machine may be of great use in raising large masses of stone, yet that such masses so raised, and carried off the field, can be of no use, except for propping mill-dams, or other similar purposes. It would, therefore, be more advantageous to blast the stones, and then each fragment would easily be reduced to such a size that it could be lifted with the hand. Thus the stones might be employed to construct fences, where their value would more than compensate the expense of removing them. It frequently happens that particular spots are filled very thick with stones, laid in regular strata, and not so much water-worn as land-stones commonly are. These are the fragments of some stratum of rock, which had decayed by the weather, or had been demolished by the rushing of torrents. When lime-stones are found in this manner, they should be carefully traced, as they commonly conduct to some stratum of lime-rock at no very remote distance. There are, however, water-worn lime-stones scattered here and there through land, provincially called *stammerers*; which, though they have also been detached from the out-crop of some lime-stone rock, have been conveyed from a considerable distance, and afford no certain indication of the bed from which they came. It is of great importance to have land effectually cleared of stones, for there is frequently more expense incurred in one season by the breaking of ploughs, and injury to cattle and harness, by working of stoney land, than would remove the evil. It has also been observed, that the soil around stones is commonly the best in the field. When stones occupy the surface, it is so much land lost; when they are below, but within reach of the plough, the ground around them for a considerable space cannot be stirred, and is therefore useless. Removing the stones, therefore, he says, is like purchasing an additional quantity of land at, perhaps, so low a rate as one year's purchase, while the part that was free of stones is rendered capable of being wrought with much greater rapidity and cheapness.

Where it is necessary to clear land of wood, with a view to its cultivation, various methods have been adopted. In America they judge of the value of land, 1st, from the species; 2d, from the size of the trees which grow upon it. Large oaks are always preferred, because the oak never attains an immense size, except upon a strong and deep soil: the wood is also more valuable on being removed. Large trees of any kind never have brush or underwood beneath them, and they stand at a considerable distance from each other. They begin with ringing the trees, that is, cutting a ring of bark from their stems a little above the ground. This checks their growth, and renders the wood more firm and valuable after they are cut down. This is generally done a year or two before they begin to fell the wood. When the trees are felled, if they be within the reach of water-carriage, they are formed into logs, planks, staves, shingles, and the various articles with which they supply the West Indian markets. The branches are burnt upon the ground, and the ashes partly manufactured into pot-ash, partly scattered over the surface, to excite the fertility of the soil. It is understood that the value of the wood commonly repays the expense of clearing it. The stocks and roots are allowed to remain in the ground; but in that climate they very speedily rot, and soon occasion no interruption to the plough. He conceives it would be better to cut the trees at such a depth below the ground, that the plough could never reach the stocks, and then fill up the holes with earth; but in America the saving of a little surface of land, even though that saving should render the remainder easier cultivated, is seldom attended to. Meanwhile

the interstices between the stocks receive a slight scratching with a miserable plough, and are sown with such grain as they are thought best adapted for. The produce is generally very considerable during a number of years; for the leaves of trees which had fallen for ages, and which speedily rot in that country, have left a sort of natural manure to fertilize the soil. Of this manure they make a very bad use; for the same crop is often continued, he says, twenty, thirty, forty, or fifty years upon the same land, without interruption, or any new addition of manure, until it no longer carries the seed. These operations are generally carried on by a class of men who have no other capital but their labour and their tools. They may be considered as the pioneers of agriculture, who advance in the van to demolish those trees which oppose its progress. But it is a pity that while they remove obstructions, they should be permitted to waste and exhaust the natural fertility of the earth. A piece of land, scalped and mangled in this way, will afterwards require more expense to put it into a productive state, than would have been necessary to clear it from wood. This is ultimately done by men of capital, who purchase tracts of cleared land, and cultivate them upon a more rational system. The pioneers find it more their interest to advance upon new land, than to persevere in the cultivation of what is already cleared.

But it is remarked, that though in this country there are many tracts of waste land, which would be better occupied by trees than by any other mode, as, in many places, trees are wanted for shelter, in others for ornament, yet there are many useless patches of trees and shrubs interposed among the cultivated land, which it would be proper to grub up. Often do we see a swaggle, with a few miserable alders, or dwarf willows, lying in the midst of good land, which it disfigures and annoys. If stones be not at hand, the brushwood of such a place might be used to fill the concealed drains; and what is now a blemish, be converted into the best land in the field. Some trees send their roots deep into the earth; and to be rid of such it is only necessary to dig to the bottom of their stocks, cut a few of their lateral roots, and pull them down with a rope. Others extend their roots a little below the surface; and such roots must be removed before the plough can pass through the land. There is no mode so effectual, in such cases, as trenching with the spade, and tearing out the roots with a pick-axe; by this, the roots are not only completely extracted, but the land may be laid into a convenient form. The roots and brushwood being burnt, and the ashes spread, the produce, he says, will more than repay the additional expense of trenching, or digging up the soil.

It is observed, that broom generally prefers a dry, gravelly, or sandy soil; the whin (furze) thrives best on a strong soil, approaching to clay, but which is, at the same time, dry; the bramble delights to grow and spread itself in such soils as are adapted for the broom; the black-thorn and hawthorn commonly occupy those places where stones, or points of rocks, guard their dominions from being assailed by the plough: there their seeds, voided by birds, take root among the land-stones and weeds, commonly thrown into such places; and, when they attain maturity, they are perpetually extending the bounds of their empire, by suckers, or by dropping new seeds: but a sheltered bank, of a strong rich soil, is the situation where thorns attain the greatest perfection. The dwarf-willow always thrives best on a damp moist soil.

Land that is overrun with any of these shrubs, may be reduced into a state of cultivation. When broom and whins have not acquired large stems, or large stocks, in consequence of having been frequently cut over by the ground, they may be cut down by a strong short scythe, or hedge-bill, and afterwards rooted out by a strong Scotch plough, drawn by four or six horses. All the roots that can be removed should be gathered, the land again cross-ploughed, gathered as before, and afterwards braked. These operations should be continued until no more roots can be found; for, if roots are left in the moist parts of the soil, they soon spring with new ardour, and the land is more infested by them than before. The same observations are applicable to thorns, brambles, and other shrubs of that nature: when all the roots are collected, they should be burnt in heaps, along with the shrubs, if not wanted for other purposes, and the ashes equally sprinkled over the ground. When shrubs of any kind have acquired large stems, or stocks, the common practice is not to cut them down, but to hole them out with spades and pick-axes, as in the case of trees. When this practice is adopted, it is previously necessary to fire whins, in order to uncover their stems and roots. After the roots are torn out on one side, the stem affords a handle, at which one man can pull, while another works below, until they have rooted out the shrub. A strong lever, shod with iron, and having the iron shoeing bent a little upwards by a gentle curve, is a powerful instrument for rooting out shrubs. The iron extremity should divide into two prongs, with an edged angle, similar to a hammer for drawing nails. Such an instrument may be thrust in below a shrub of any kind, until it seizes its tap-root, and, by the aid of a stone or block of wood, to serve as a fulcrum, the shrub may be rooted out by one effort. These kinds of plants may likewise, in a great measure, be kept down, especially where land has been in some measure cleared previously, in the mode just mentioned, by pasturing well with sheep.

It has been often found, after much expense has been incurred in clearing land of shrubs, that they get up again an hundred-fold, after the land is thrown into pasture; this must be imputed partly to the seeds, and partly to the small roots left in the ground. Pasturing with sheep, he says, in this case, appears to be the only remedy. If, after all, they threaten to get the better of the sheep, they should be ploughed down again, before the roots have acquired strength to resist the plough, and the preceding operations repeated. There is a peculiarity in whins, that, though they delight in a strong, deep, and friable

soil, they will not spread upon moss, upon washed loams, or soils that are saturated with animal or vegetable matter, though they be laid sufficiently dry for their reception. Lime they abhor, and an effectual remedy against their resuming possession of a field, seems to be working and manuring it sufficiently.

With respect to broom, the best plan seems to be changing the quality of the soil on which it grows: as it prevails chiefly upon gravelly and sandy eminences, which are replete with their seeds, as well as roots, a strong dose of clay marl would change the texture of the soil, and render it uninhabitable by them. If marl cannot be got, a compost of moss and lime, or of clay and lime, would answer the same purpose.

It is remarked, that heath is a plant of the most hardy nature, and grows only upon the most sterile soils. By sterile, he does not mean soils absolutely incapable of being rendered productive, but such as have received no melioration from working and manures. The natural goodness of a soil may be known from the size and vigour of the heath which grows upon it, just as the Americans judge of the value of land, by the size and species of the trees which it carries. If the land be relieved of its dampness, and the heath burnt upon the surface, it will, in time, be extirpated by sheep. These animals are excessively fond of the tender shoots and flowers of heath, which seem to be medicinal to them, though nothing but extreme hunger can induce them to taste it after it runs into seed. Lime is a most mortal enemy to heath, and we shall see that it can easily be extirpated by that weapon. The plant abounds in the gallic acid, and grows only upon such soils as are replete with acids: lime, he thinks, by neutralizing these, robs the plant of its natural food.

Long heath makes a most excellent thatch for houses, far more durable than straw of any kind; it also makes excellent rinses for scrubbing milk-vessels. From its extreme durability, it is the best of all plants for making concealed drains: where, therefore, it prevails in a field that is about to be reduced into cultivation, it should be cut down as closely to the ground as possible, with a strong short scythe, and applied to any of the purposes mentioned; or it may be burnt early in spring, as it grows upon the ground, together with all the coarse grasses that are intermixed with it. A strong plough may then be employed to turn over the soil, though it cannot be advantageously ploughed with long heath growing upon it, as this prevents the furrow-slices from coming in contact with each other, and thus from retaining moisture to rot the sward. A strong dose of caustic lime, laid upon the surface of the ploughed land, in the course of about six months, consumes the roots of heath and coarse grasses, renders the soil friable, and prepares it for a crop. Some lay a dose of lime upon the land before it is ploughed, and another after, that the furrow-slices, being wholly surrounded by lime, may the sooner be brought into a friable state. Indeed, economy in the use of this ingredient, at the first breaking up of moor-land, is economy misapplied; but it should be laid on in a finely powdered state, highly caustic, and as equally as possible. For reasons frequently repeated, he is, however, inclined to think, that it would be most profitable in the issue, if the expense could be spared, to turn up wild land of every kind, for the first time, by the spade. This must, however, depend wholly on the expense of labour in the place where it is to be done.

Burning coarse herbage has been recommended, in certain cases, where it does not admit the plough; but when land is pared, a thin sod is taken off, either by a paring-spade, or paring-plough, over the whole surface. The sod being dried, is burnt in small heaps, and the ashes scattered over the whole field. Swampy land, that is overrun with rushes and coarse grasses, and lands that are covered with heath, ling, and other coarse plants, as well as ant-hills, answer best for paring and burning. This practice destroys these coarse plants at once, and admits the land to be ploughed and cropped immediately, without waiting for the rotting of the turf, as in the former case; it is also said to destroy all slugs, and other vermin, which infest the soil.

It is also recommended, in breaking up cold tilly soils, or when they are covered with rushes and coarse herbage, the rushes, &c. being first cut down with a scythe, and removed with a strong plough that penetrates to a great depth, to draw two deep furrows, laid up against each other, so as to form the crown of a ridge. With a parting-plough, or spade, to follow the plough, and strip off a sod of about an inch in thickness, and the breadth of a furrow-slice. This sod being thrown into the bottom of the furrow previously made, with the heathy or rushy side undermost, can be trod down by a man who follows the spade, or paring-plough. Lastly, the strong plough should follow the paring-plough, and heave up the earth, which it had laid bare, to the depth of about a foot, throwing it over upon the sod, previously placed in the opposite furrow. It is presumed, that a sod composed of short heath, rushes, or other coarse herbage, being buried at such a depth below the surface, would ever after keep the soil open, and allow the water to percolate, while a great depth of soil would be obtained.

It is further remarked, that when land is to be fallowed, with a view to lay it into proper form, other instruments, beside the plough, are frequently necessary. He has seen many levelling-machines, for reducing inequalities, and for scooping out slope drains, where necessary in a field; but he never saw any that did not do infinite mischief to the land on which they were used. They require immense force: of course, every animal that drags them sinks to the knees at every step, and leaves holes in the soil, in which water will lodge for ever. They leave no choice of the spot, where what is dragged out of one place, is to be deposited. The nearest hollow is the spot where, right or wrong, the contents of such machines must be dropped. Where such machines operate upon deep, loamy, and friable soils, they may do no mischief, though all their effects may be

attained in a much more cheap and economical manner; but he has seen some land wholly spoiled, and rendered unproductive, by the use of such machines. Before land is levelled or sloped, being previously ploughed, the different qualities of its soil should be accurately inspected, and the different materials that are taken up ought to be deposited in those places which are most opposite to them in quality. Thus sand, gravel, or rich earth, ought to be dropped upon stubborn clay, and *vice versâ*. If there be a patch of bog, or moss, being previously under-drained, if necessary, it should be sloped so as to discharge the superficial water. The earth taken out of such places will amply repay the expense, for it will operate as a manure to the other parts of the land. Still more will it operate in this way, if made into compost with lime, or dung, or both, and frequently turned, until the parts are completely rotted and incorporated: throwing water upon it, during the turning, hastens the putrefaction of its vegetable matter. We frequently meet with patches of bog, or moss, interposed in the corners of arable fields, which are never touched by the plough. Though they be under-drained, they are seldom sloped so as to discharge the superficial water. The farmer does not know that such places are magazines of manure, for his other lands. As it would be proper to lay the earth, taken from such places, on the solid land, so it would also be proper to lay what is taken from the solid land, upon bog or moss.

The most economical way of removing earth, with which he is acquainted, is by wheelbarrows, running upon coarse deals, or by light single-horse carts, or small carriages, running upon low broad wheels, or rollers, and drawn by a single horse. High vehicles, such as the English waggons, occasion an immense waste of power, in raising the earth to an unnecessary elevation. When the distance does not exceed fifteen or twenty yards, wheelbarrows are most economical; though it has already been observed, that the object should not be to throw down what is removed upon the nearest spot, but upon that spot where it will contribute most to the melioration of the soil. When earth is once lifted, the additional carriage which this may sometimes require, is of no importance, compared with the magnitude of the object. Where the subsoil is very bad, the superficial soil may be laid aside with the spade, and only the subsoil removed. If, in levelling a piece of land, it be found necessary to expose an aluminous or pyritical subsoil, it should be laid up in drills, or trenched with the spade, the pieces laid in drills, or built like dykes, and allowed to remain in this state during a winter or two: when afterwards levelled, such spots may receive a double portion of lime and dung. There will be no loss occasioned by not sowing spots where nothing will grow. When high ridges prevail in a rich soil, of great depth, they may be levelled without danger during the course of a fallow. Where there is only a thin paring of superficial soil, with a very bad subsoil, it is often dangerous to attempt this by the plough, as it buries down all the good soil, and throws up the bad; yet these high ridges are a great nuisance to land; their furrows are generally canals, or reservoirs of water; their sides are pared and scratched to the bare bone, in order to accumulate soil upon the top, where it is become, in the language of the farmers, deaf: thus very little grows upon the sides of such ridges, and the top either labours under defect of moisture, or the crop gets too rank and lodges. They have still another defect, that grain never ripens equally on all parts of them. The great object, in such cases, is to get the land reduced to a level, and yet to distribute the good soil at an equal depth over every part of it. He has seen farmers use a levelling-machine, or drag, for this purpose, drawn by a great force of cattle: this instrument may do no harm, where the good soil is of a great depth; but on such as he has seen it used, it is impossible to contrive any thing more pernicious or improper. See *Machine*.

But where the expense of labour is not too high, a thorough trench delving with the spade, is certainly the most effectual, and likely to prove, in the end, the most profitable method of reducing high ridges, as it admits of an equal distribution of the good soil. There is another method with the spade, much cheaper than a complete trenching, as no more of the earth is removed than is necessary to raise the furrows on each side to the level of the ridges; the one is lowered while the other is raised. In doing this, the superficial soil on the top of the ridge is laid aside; then the bad soil under it is thrown into the furrows on each side, until, by raising the one, and lowering the other, they are brought to a level. Meanwhile the good soil is tossed and scattered, so as equally to cover the whole. The land should then undergo a complete fallow with the plough. Dr. Anderson, in his Essays on Rural Affairs, he says, describes a method of effecting this object, partly by the spade, and partly by the plough. The plough is dragged across the ridges, and turns over a furrow-slice of superficial soil: at every ridge, or such number of ridges as he can command, is stationed a man with a spade, who, before the return of the plough, scoops out the subsoil from the bottom of the rut, on the top of the ridge, and throws it into the water-furrows on each side, until, by lowering the ridge, and raising the furrows, the whole is reduced to a level. This method is upon the same principle with the one just described, except that the plough is used for laying aside the superficial soil. It seems to have succeeded very well; but it requires a great number of hands, which, in many situations, a farmer cannot probably command at all, or not without too heavy an expense.

In the clearing of moss-lands, much has been effected in many districts, in the northern parts of the kingdom, by digging them up, and floating them away, by the waters of rivers, in their vicinity, being turned into canals, cut in them for the purpose, by machinery or other means. See *Moss-Land*.

CLEAS, a provincial word, applied to the claws of cattle, sheep, &c.

CLEDGY, a term applied to such sorts of land

as are stiff, stubborn, hard, tenacious, or mixed with clay.

CLEFTS, in *farriery*, a disease in the heels of horses. See *Cracks in Heels*.

CLETCH, a young brood, as of chickens, &c.

CLEVVY, a provincial word, applied to a sort of draft-iron of a plough.

CLIMATE, a certain space upon the surface of the earth, or a region or tract of land, varying in the temperature of the air. The author of Modern Agriculture observes, that "it is the first natural advantage of every country; that which is absolutely requisite for animal, as well as vegetable life; that without which, soil and cultivation will avail little; for although soil may be improved with complete success, climate cannot to any very considerable extent. It is well known, that, besides the particular situation of a country on the globe, other circumstances combine in forming its climate; such as its elevation, proximity to oceans, seas, mountains, marshes, soil, and the like; upon such natural causes, the climate of this country, he says, depends; and from these receives its character. There are three distinct characteristics of our climate, that cannot escape the observation of those who have made it an object of attention, and from which its advantages or disadvantages must appear: 1st, its mildness; 2d, its variableness; and, 3d, the productions dependent on it."

In respect to the first: "From the high degree of north latitude in which this country is placed, one would not at first, he says, suppose, that its air should be naturally mild; yet, on being compared with the temperature of other countries, in the same parallel of latitude, it is certainly entitled to this character. The city of Moscow, about half a degree south of Edinburgh, is very different in point of climate. In the former city, so rigorous is the winter, that it is not uncommon for people to perish by cold; the lips, noses, ears, and fingers, of the inhabitants, are frequently frost-bit; and water, thrown from a window, falls on the ground in ice; such severe effects of cold may be said to be unexperienced in the latter city, or in any part of the island. The island of Newfoundland, a distant branch of the British empire, lies in a lower latitude than England, and yet the extreme colds in winter, and the excessive heats in summer, render it very disagreeable to the inhabitants. The same holds in regard to Canada, though situated in the 48th degree of north latitude: the climate, in point of mildness, is not equal to that of the mother country. Nay, in point of mildness, Britain excels lands on the Continent, which one would think should have naturally enjoyed a softer climate. We hear, with surprise, of the great falls of snow, the severe and long-continued frosts, the sudden transition from these to sultry heats, excessive rains, destructive hurricanes, and tremendous thunder-storms, lightnings, and earthquakes, which scourge those countries, whose inhabitants we are ready to envy, on account of their favourable climate; while, unconscious of our own happiness in this respect, we little think, that, in general, we breathe a purer air, untainted by noxious vapours and fiery particles, that engender disease and death. In winter, too, our bodies are seldom so cramped with cold, or, in summer, so relaxed by heat, as to unfit us for pastime or labour. This singular felicity of this island, as to climate, may be accounted for from its connection with the ocean. That immense body, from being always in motion, from never freezing, and from constantly inhaling the rays of the sun, possesses a considerable degree of natural warmth. Of consequence, the vapours exhaled from the sea, by the action of the sun, and which necessarily partake of the same warmth, when they mingle with our atmosphere, must soften the coldness of the air. This is effected more especially by the south-west winds, which are prevalent in this country. These, by the time they have crossed the Atlantic, and reached our coasts, must be charged with those nutritive principles and genial vapours, which, being impregnated with the colder air of this island, descend in gentle dews and rains, that fertilize the soil. The same holds, though not in an equal degree, in regard to the wind that blows from the north: though colder than the west wind, in as much as it proceeds from countries nearer the pole, yet, in passing over the ocean, it imbibes a portion of its warmth; and, when it reaches this country, is comparatively warmer than when crossing the frozen mountains of the north. Hence, the reason why snow seldom lies above a few days on lands adjacent to the sea-coast; hence, too, the influence of sea-breezes, operating with other internal causes, namely, the natural fertility and warmth of the soil, the extensive woods and plantations, with those canals and rivers that carry off superfluous water, the high state of cultivation, the many cities, towns, villages, houses, and animals, all combine in tempering the climate of this island; insomuch, that it cannot be said that, in any part of the island (high lands excepted), the climate is so intemperate as to prevent grass growing, grain ripening, or the inhabitants from enjoying the comforts of life. Upon the whole, it appears, that a happy concurrence of circumstances renders the climate of this country milder than that of other countries, which, from their local situation on the globe, might be expected to enjoy a more desirable temperature."

In regard to the second distinction of climate, he remarks, that, like the ocean that encompasses the island, our climate has been represented as inconstant, unsettled, varying in the space of a few hours, from dry to moist, from heat to cold, from clear to cloudy, and from the most pleasant serenity to all the violence of tempest. "He must, indeed, he says, be an enthusiastic admirer of the climate of Great Britain, who can give it a preference, in point of uniform steadiness, to the climates of some continental countries. It must be admitted, that Britain does not enjoy that permanency of clear and warm weather, nor that agreeable vicissitude of seasons peculiar to some kingdoms; nor is this possible, without the subversion of those laws which re-

gulate seasons and their changes. Upon the principles already laid down, it is obvious, that the island of Great Britain, washed upon three sides by immense bodies of water, must necessarily be effected thereby; and it is impossible that its climates should be so uniformly steady as that of other countries, situate in the centre of a vast continent, and sheltered by ranges of mountains from the frequent inclemencies of winds and waves. To such natural causes must be ascribed the sudden and frequent variations of our climate, felt at times so uncomfortably by the natives; and which draw from those habituated to more constant climes heavy complaints against our atmosphere. These irregularities of climate, however disagreeable, he says, lay a foundation for advantages more substantial than any that result from a more pleasant and steady temperature of the air. It is not in countries where the seasons of heat and cold, wind and rain, are periodical, or where the greatest regularity of climate takes place, that mankind are most vigorous, or the fruits of the earth most perfect. There is a sameness of climate, as well as of other things, that is prejudicial to man. Besides, the air, from being long acted upon by heat or cold, moisture or dryness, is put into a state no less unfriendly to vegetable than animal tribes. But in Britain, the air, from being refined and quickened by the frequent changes it undergoes, is in little danger of being affected by such causes. In spring, it must be admitted, that the country is frequently drenched with rain, and the seed-time, of course, interrupted. But, excessive as the rains sometimes are, their bad effects are generally prevented by the keen sharp winds and dry air that quickly follow; in so much, that a few days after it cannot be known that such weather had prevailed. It accordingly seldom happens in Britain, that the active husbandman is prevented, by the inconstancy of the weather, from ploughing the land, and sowing the seed in season: seldom is that seed killed in the earth, or, when sprung, withered in its tender blade, either by untimely frost or inclement winds. In summer, the verdure of our hills, and luxuriancy of our crops, are seldom blasted by a long continuance of dry scorching weather, or immoderate falls of rain. Sunshine and shade, genial warmth and moisture, succeed in grateful variety, and render our summer no less delightful to man than friendly to vegetation. The climate in harvest resembles that of spring, the weather suddenly shifting from ripening showers and mild sunshine, to heavy clouds and sudden bursts of rain, that seem to threaten the promised harvest. Yet often when the heart of the husbandman is ready to despond, he beholds the season return in all its beauty, and has reason to acknowledge with gratitude the truth, that seed-time and harvest have not failed. From autumn to the end of the year, the climate of Britain is, he says, most variable, and its inconstancy is the more ungrateful from the advanced period of the season. Then the days, as well as nights, are liable to frequent changes, veering between frost and thaw, snow and rain, clearness and fogs; while often obscure and joyless rains descend, which deform the face of nature, and depress the spirit of man: yet it should be remembered, that these rains fall at a period when the fruits of the year are secured, when nature reposes (with the husbandman) after labour, and when, from the shortness of the day, little can be done without, and men are disposed to enjoy comfortable society within doors. Philosophers also maintain, that our rains, in consequence of proceeding more immediately from the ocean, are more pure, and more impregnated with salts, than the rains which fall in most other countries; and though sometimes falling in prodigious quantities, yet tend to fertilize the soil. The climate of Britain in winter partakes of the same variableness that distinguishes it in other seasons. Sometimes the weather is open and mild; at other times frost sets in, and is succeeded by heavy falls of snow, which cover, for weeks, the surface of the earth. However much the inhabitants may then suffer from the inclemency of cold, it is generally understood, that the effects of frost and snow are, upon the whole, friendly to vegetation. Frost, by expanding the water or moisture contained in the soil, separates the particles of earth from each other, and thus renders the soil more loose, tender, and friable, than it would have otherwise been. This holds especially in regard to tough clay, upon which frost acts with a salutary effect, by reducing its stubborn nature, and rendering it more fit for vegetation. The snows, so frequent in Britain during winter, tend in various ways to fertilize the soil. Our winter snows, by covering the roots of vegetables, such as rye, wheat, &c. preserve them from the killing colds of the atmosphere. By snow covering the surface of the earth, its heat is cherished. Upon the principles of those who make oil the food of plants, snow must necessarily, he thinks, be a great fertilizer of the soil, from the oily particles it contains. Besides, snow, when it melts, moistens and separates the soil which had been bound up by the frost; and, as its water tends to putrefaction, it must, independently of the nitrous particles with which it is supposed to be impregnated, be greatly in favour of vegetation. In fine, says he, if the climate of Britain be less agreeable than some others, it has more variety."

The third criterion of the climate of this country is, he says, its productions. "From these the excellence or the defects of climate must be ascertained. These are evidences to which a safe appeal may be made. They are not, like natural causes, liable to be mistaken or misrepresented, but are open to the inspection of all. The productions dependent on climate are plants, flowers, trees, grain of all kinds, nay, animals, such as men, horses, cattle, sheep, &c. Upon a fair comparison of these with similar productions of other climates, a just estimate of the excellence of the climate may be formed. It is true, he says, that there are fruits of various kinds that cannot arrive at maturity in Britain. Some natives of the torrid zone, when imported here, quickly languish and die; others, when introduced with much fostering care, may thrive for a season, yet

from the influence of the air are soon stinted in their growth, and degenerate. But such fruits in general contribute only in a small degree to the subsistence of those who enjoy them, and may be regarded rather as luxuries than necessaries of life. Wheat, barley, oats, peas, beans, rye, cattle, sheep, swine, poultry, &c. are the great articles which constitute the food of man; and these our climate is calculated to produce in plenty and perfection. Upon the whole, from the comparative mildness of our climate, from its varieties, by no means unfriendly to vegetation, and the perfection of fruits, and from the productions which depend on it, it appears, that in regard to this first and great natural advantage of a country, Great Britain has been favoured in a considerable degree."

It is stated by Mr. Middleton, in his Account of the State of Agriculture in Middlesex, that "the temperature of the atmosphere, except perhaps so far as the influence of the London fires extends, is nearly the same through the whole county, there being no situation so much elevated as to produce the cold and thin air that we find in mountainous countries. In general, it is healthy, owing to the greater part of the soil being naturally dry; and the more moist situations being well drained, are consequently free from those unhealthy vapours which usually arise from stagnant waters. The fires of London, in which are consumed about 600,000 chaldron of coals annually, have a sensible effect on the climate in its neighbourhood, by drying and warming the atmospherical air; which, being thus rarefied by heat, constantly passes upwards, and makes way for a fresh supply to come in from every side. The most stationary winds are from the south-west and the north-east; all others are variable and unsettled. Those from the south-west are supposed to blow nearly six-twelfths of the year, and those from the north-east about five-twelfths. The varying winds blow from all the other points of the compass about the other one-twelfth. Perhaps, he adds, it would be more accurate to say, that winds from various points at and nearly the south-west blow about twenty-five, north-east, twenty, and from the rest of the circle, nearly seven weeks in every year. The winds seldom blow with so much force in this district as to shake the grain out of the ripe ears of the standing corn. The greatest falls of rain generally come from the south, or perhaps from a point or two west of the south, and are most certain when the wind has passed through the east to the south. In the spring months, the damp on low ground is sometimes congealed by cold, when there is no such appearance on the hills, and thereby some of the young shoots of the more tender shrubs and plants are destroyed in the former situation, when no injury happens to those in the latter. So great have been the extremes of heat and cold, at some particular times, that on the 16th of July 1793, the thermometer rose as high as $83\frac{1}{2}°$, and on the 24th of January 1795, it fell down to six degrees below 0; though this, perhaps, is the greatest difference in respect of climate ever observed in this kingdom: happily, however, it never continues more than a day or two at such extremes. The salubrity of any district is certainly affected in a great degree by the state of the soil, and shape of the surface of such district; and hence it follows, that the natural climate of most or all countries may unquestionably be considerably improved by using the means best calculated to procure an equable degree of shelter, dryness, and moisture; all which may be effected in bleak, dry, and comparatively barren situations, by dividing them into small inclosures with broad hedge-rows and plantations, in belts of several yards wide; and in low flat situations, by draining off the stagnant water, by enlarging the inclosures, thinning and clipping the hedge-rows: in some instances, by grubbing up not only these hedge-rows, but also copses, woods, and plantations, thus removing every obstruction to a free circulation of air. This will necessarily absorb and carry off the redundant moisture, and consequently render the climate salubrious and comfortable. Indeed too much attention cannot, he says, possibly be paid, in cases of inclosures, plantations, &c. to the grand articles of drainage and shelter, and also to the nature and situation of the soil; as by a proper regard to these objects, not only the healthiness of the climate, with respect to animals, will be promoted, but the fruitfulness of the soil will be increased in a degree not otherwise to be expected."

Much advantage may, in many cases of the culture of the soil, be derived from an intimate acquaintance with the nature of the climate, especially as, in the improved state of the art of agriculture, many of its operations are bestowed upon such plants as are exotic to the situation in which they are cultivated. The want of the knowledge of properly adapting the management of different articles of culture, to the changes of climate, has been often productive of disappointment and failure in such as might otherwise have been of great benefit and importance to mankind. Daily experience fully shows, that the vegetable productions of one climate may, by proper attention, be readily naturalized in another. The advances of agriculture in this way have been great, but much still remains to be effected, which a better knowledge of the nature of climate may have the tendency of greatly facilitating.

CLIMATURE, a word sometimes employed in much the same way with climate. It is a term frequently made use of by some agricultural writers.

CLIP, a provincial word used to signify shearing sheep. It also signifies the produce of wool. See *Sheep-shearing*.

CLIPPING, the act of shearing sheep. This sort of business was formerly performed in a longitudinal manner, but a later improvement is that of executing it in the circular method. It also signifies a sheep-shearing. See *Sheep* and *Sheep-shearing*.

CLOCKS, a term applied to beetles of all sorts.

Clock-*Seaves*, a provincial term applied to the black-headed bog-rush.

CLOD, a term applied to a lump of earth or clay.

CLODDING-*Beetle*, a large beetle used in some districts for breaking the clods in clayey and other

stiff tenacious soils. This business may be much sooner performed, and at less expense, by means of rollers constructed for the purpose. See *Roller*.

CLODDY, a provincial word applied to cattle, when thick, short, or full of flesh.

CLOG, a provincial word sometimes applied to a log of wood.

Clog-*Shoes*, a provincial term applied to wooden shoes.

CLOSE-*Behind*, in *horsemanship*, a term applied to a horse whose hams are nearer each other than the feet, especially those parts of the hams called the hocks; and the distance still enlarging towards the feet. Such bow-legged horses are oftentimes good, yet they generally have a weak hind-hand; and in great descents are apt to strike their hams against each other.

Close-*Feeding*, the practice of eating grass herbage down, in a close manner, by sheep or other animals. It is of much consequence to the grazier, to have his pastures kept in a state of close-feeding, as the animals are found to do much better under such circumstances.

Mr. Young inserts a minute on a year's feeding, conducted with care and attention. Speaking of close-feeding, he says, "in the preceding trials there was not, through the thirty weeks, scarcely a bent to be seen; the pasturage was constantly shorn to the ground; and in that state it was remarkable to see how constantly, and even rapidly, it sprung, during the continuance of a drought that was destructive of all produce in fields on the same farm, suffered to run to bent, for hay or other views. The comparison was the most decisive that can be imagined. He had many fields, better than any here registered, that yielded so contemptible a produce of hay, as to be scarcely worth mowing; and he was amazed to see in some of them how poor the *rouen* or after-grass was, so that both united, or the entire growth of at least forty weeks, has amounted not to the fourth of the value of the produce of similar soils pared close by sheep. "A Romney-marsh grazier would be ruined if he had so much grass on his land," says Mr. Boys, in his farming tour, speaking of a field understocked." Annals, vol. xix. p. 118. "Nothing so bad," says another, "in Romney-marsh, as mowing, so that some landlords prohibit it." Pliny, says he, knew this—*Est enim in primis inutile, nasci herbas sementaturus.* Plin. Hist. Nat. lib. xviii. cap. 28. Of the fact, however, he has not the least doubt, from various experiments and observations, and there is no man but has remarked it, he thinks, in the case of ray-grass, the produce of which is lost, if the bent be allowed to rise. In all plants cultivated for pasturage, there is a great effort the moment the seed-stem runs, to which the whole growth of the plant is directed to form the seed; till then the growth is in the leaves: it is therefore palpable, that the way to have the greatest abundance of leaf, is by feeding so close as to prevent those stems rising at all. And he may further observe, that on this system of feeding, those grasses which yield a very great but coarse produce, become sweet, fine, and valuable, by thus keeping them close fed. The *avena elatior*, or tall oat-grass, is very coarse, but in a field of that grass $13\frac{1}{2}$ acres, it never was suffered to rise, and consequently was found on examination to appear as fine and pleasing to the eye as any of the more delicate grasses. It is with this view that he is cultivating it largely, and also the *dactylus glomeratus*; and both are remarkably early."

And he adds, that "it is an inquiry that deserves attention, whether the superior profit of grazing sheep, on comparison with oxen, does not depend very much on this point of close-feeding; for large cattle, the herbage must be kept to a good head, to give a full bite, and consequently innumerable seed-stems form, which tend to reduce the produce greatly." See *Grass and Grazing*.

Close-*Teap*, a term sometimes provincially applied to a ram or male sheep, where both the testicles are within the barrel.

CLOTE, a provincial word sometimes applied to the weed coltsfoot.

CLOTHING, in *horsemanship*, the practice of covering the animals with cloths, in the view of keeping them healthy, and giving a fine coat. In the use of this covering, more attention is perhaps required than those to whom the care of horses is in general intrusted are aware of. The practice of excessive clothing is but too prevalent, and lays the foundation of many diseases which are ascribed to very different causes. When a horse has stood a considerable time in a warm stable, abundantly covered, and almost concealed in his clothing, the circulation is particularly determined to the skin; the cutaneous pores are universally thrown open, and his situation resembles that of a man sleeping in blankets. In the meanwhile the animal is required for the road or the field; he is suddenly brought forth, as it were, in a state of nudity, into a cold and piercing air (for even in mild weather, in such a state, the atmosphere would be chilling), and the consequences are invariably a staring of the coat, a total stoppage of the channels of insensible perspiration, and a speedy revulsion of their contents to the internal cavities: hence colic, inflammation of the different viscera, and a long train of disorders. The practice of using the same proportion of clothing to all horses is but too common; and is exceedingly injudicious: the quantity or proportion ought to be regulated by the temperature of the stable, the season of the year, and the state of the animal's coat, which, when about to be changed, demands more than usual warmth. Horses coming from the stables of the dealers often require much clothing; but the quantity may afterwards be gradually diminished. Previously to horses being sent to grass, care ought to be taken, during the three or four weeks preceding, that the quantity of clothing be by degrees lessened; and, for the last seven or eight days, be wholly discontinued: when

taken up again, it should be as gradually applied and augmented. Horses undergoing the operations of purgative, mercurial, or alterative medicines, undoubtedly stand in need of more covering than may be usual under other circumstances.

CLOVER, the name of a well-known plant of the supposed artificial grass kind, of which there are three sorts cultivated in the open field for the food of cattle; the *red* or broad clover, the *white* or Dutch clover, and the *hop-clover*.

It is observed by the author of the Synopsis of Husbandry, that "red clover, or, as it is in some places called, broad clover, is distinguished by a large leaf, and blows, as its name implies, with a red blossom. It delights in a rich earth, and of a stiffish nature, but will prosper well on gravels, sands, or chalks. It probably however thrives best in clayey or strong deep loamy soils. The above author thinks that the most convenient time for sowing this grass is with the oats in February or March, or among the green wheat in those months; though it is not unfrequently sown with the barley in April; but in this latter case there is danger of its growing to such a height amongst the corn, as to occasion the barley to lie so long abroad at harvest, that the clover may be withered, and hence great mischief may accrue to the barley, if much rain should fall ere it can be brought into the barn; or the barley may be much lodged, so as to destroy the clover, either of which are inconveniences that one would wish to avoid; and for these reasons, clover is rarely sown among barley on good lands: but on thin soils these accidents are less to be apprehended."

Mr. Young remarks, that "there are several methods of sowing this seed, which is so profitable upon almost every farm, that it must be had if possible.

"1st, In the drill-husbandry, it may be sown and harrowed in, at the time the barley is sown broad-cast; a pair of light harrows at the same time following the drill-machine, to cover the clover-seed.

"2dly, It is sown before the roller, when the barley is four inches high.

"3dly, It is hand or horse-hoed in, when the corn receives either of those operations, if the farmer is in the practice of giving them.

"These are the methods most commonly used. Mr. Ducket, he says, drilled the seed in the same drills as the barley, but that way is very uncommon. Another way he has known, has been that of scarifying the barley-stubble in harvest on light soils, and sowing the seed alone then." But "of these methods, the first is, he thinks, the surest for a crop, and the most to be recommended, notwithstanding the admitted evil which sometimes takes place in a wet season, of the clover growing so luxuriantly as to damage the barley. The second succeeds well, if rain follows in due time, and would perhaps generally succeed, if the farmer ventured to harrow it in, which he might safely do. In the third method it often succeeds, but it also often fails; nor is it necessary, in many cases, to hoe the barley."

The same writer adds, that "in regard to the quantity of clover which the farmer sows, he has several considerations to govern his determination. In the first place, it is in many situations, and on many farms, as profitable a crop as any other he commonly reaps. On tolerably good land, he may expect, at two mowings, three tons of hay; on good, three and a half, and even four. Or, if he applies it to soiling his teams, for want of lucerne, the produce in a different way is equally striking. This produce is also gained at a very cheap rate; cheaper than he gets any other crop. Add to this, that it forms an excellent preparation for either beans or wheat. Still, however, the quantity to be sown will depend in some measure on his having lucerne, sainfoin, or a great plenty of meadow-land. If he is deficient in these, it becomes more than useful, it is essential." But, says he, "the unfortunate circumstance which attends clover, is its being extremely apt to fail, in districts where it has been long a common article of cultivation. The land, to use the farmer's term, becomes *sick* of it. After harvest he has a fine plant, but by March or April, half, or perhaps more, of it is dead. This makes a new course of crops necessary. Instead of its occurring once in four years, in the common Norfolk course, it becomes necessary to sow it only, he says, in the second round alternately, beans after barley in one course, and then clover in the next. This has been found to answer. This observation, however, should be made not without observing, that on a farm at Morten in Surrey, Mr. Arbuthnot, by means of deeper ploughing than common, and ample manuring, succeeded well with clover every third year in this course: 1. beans; 2. wheat; 3. clover, on land that was said to be sick of it, though sown before only once in four years. He viewed his crops in that new course during three rounds, and never saw finer."

He states, that from "ten to twelve pounds an acre is the usual quantity of seed, but that fifteen is better."

As clovers are liable to decline or go off, the above writer advises that, "very early in April, and, in some seasons, in March, the young clovers should be carefully examined, as a full plant in autumn often dies away in winter and spring; so that, by this month, the farmer, perhaps, is in doubt whether he shall let it stand, or plough it up. In this case, it is highly advisable to dibble into all the vacant spots spring tares, which thus take extremely well, and, between clover and tares, a very ample crop is produced."

It is, however, stated by Mr. Donaldson, in his account of the present state of husbandry in Great Britain, that the quantity of seed allowed to the English acre, when it is intended to plough up the field after the first or second year, is from ten to fifteen pounds, to which is commonly added, about a bushel of rye-grass seed. It was formerly, he says, considered improper to sow grass-seeds, of any kind, along with oats, barley, or other white-corn crops. This

opinion, however, has been clearly and satisfactorily proved to have been ill-founded, and must have been at first promulgated by those who were better acquainted with the theory than with the practice of agriculture. Every practical farmer now knows, he says, that if a crop of grass be the principal object in view, there is a greater chance of its proving abundant when the seeds are sown with barley particularly, than when sown alone. This fact is so completely established, that there are, it is presumed, few instances where the method above-mentioned is still adopted. The general practice is, to sow not only red clover, but all other grass-seeds, with oats or barley, in the spring. When the seeds are sown, which is usually done as soon as the grain is harrowed in, the field is again gently harrowed, and afterwards rolled, so as to cover the seeds, and smooth the surface of the field, that the scythe may pass easily over it the following season. Red clover, when the seed is sown along with, or rather immediately after barley, and at the rate of twelve or fifteen pounds to the acre, frequently overtakes, or overtops, the crop of barley so much, as materially to injure it. Were the clover-seeds not sown till the barley had vegetated to the height of three or four inches, he thinks this loss and inconvenience would, in all probability, be avoided; at the same time, the crop of barley would rather be improved than injured, by a light harrowing at that stage of its growth, while the clover-seeds would vegetate as freely, and the crop of grass prove as abundant, as if the seeds had been sown at an earlier period.

As it is an established rule, in many districts, for an entering tenant to pay the one who removes a certain sum, from 10*s.* to 20*s.* the acre, for liberty to sow grass-seeds along with the outgoing tenant's barley, it is fair to presume, he conceives, that this rule has been established on proper principles, and that the payment so made, is no more than an equitable compensation for the injury which the removing tenant sustains by granting this permission. If so, the average loss, of 15*s.* the acre, which is incurred by sowing red clover along with barley-seed, must appear, says he, of considerable magnitude to those who sow a fourth, a fifth, or a sixth part of their farms, every year, with barley and red clover-seeds. The method above suggested for obviating this loss and inconvenience, cannot possibly be attended with any bad consequences, to either of the crops in question; and as it would, in all probability, prevent this evil, which is so generally complained of, it certainly merits the consideration of those who, having repeatedly sustained heavy losses, from the failure of their crops of barley, are, of course, more immediately interested.

The writer we have first mentioned observes, that "on farms where there are kept large flocks of sheep, there is an absolute necessity of sowing annually many acres of this grass, that there may be no want of feed for the stock during the summer-months. For this reason, clover is often sown on land that is improper for its cultivation; in which predicament may be ranked such poor fields where the juices of the ground have been exhausted by repeated crops of corn. But though large burthens of clover cannot be expected from such worn-out soils, yet the farmer, in the circumstances above alluded to, acts a prudent part in sowing the seed, for this will considerably improve his grattens in the following autumn, and furnish the sheep with food during the first part of the winter; and if the clovers may not have taken sufficiently thick to stand for a crop, or that the ground be intended to come in course for corn that year, or for a fallow, such mode of husbandry may be pursued, without an apprehension of the least damage to accrue from the growth of the clover. On these accounts, it will redound much to the interest of a farmer, who keeps a large stock, not only to raise many acres of this grass annually, with the express view of reserving it for a crop to supply the stock with green meat throughout the summer; but, in particular cases, as when from the abundance of the crop the seed is but of an inferior value, or there is a probability of there being required on the farm a larger supply of sheep-keeping than usual, to sow a sprinkling of clover-seed, in a variety of fields, among the wheat, oats, and barley, though such ground be intended for tillage the following spring.

"The best clover-seed is that where the purple colour chiefly prevails, and which is most free from the seeds of weeds, of whatever kind. When clover is designed to stand for a crop, the best method of preparing the land for this use, is to allow a liberal quantity of dung on the turnip-fallow, and the turnip-seed being thus sown on fallows properly conducted, will, in all likelihood, produce a good crop of that root; and, if the spring should turn out kindly, the turnips may be eaten off, and the ground reduced to a tilth, for sowing the oats and clover-seed in March. Three bushels of oats, in this case, is the proper quantity to the acre: if more seed were allowed, the crop, from the extraordinary tillage bestowed on the land, would probably throw out too great a quantity of straw, so as to be early lodged, by which the welfare of the clover would be endangered. As it is of consequence that the ground should work kindly at the time of sowing this and all other grass-seeds, the utmost care should be taken to get it into a due preparation for that purpose; and as the turnip-ground is frequently baked very hard, by the treading of the sheep, in a wet winter, so that such ground is apt to break up in large clods at the first ploughing in the spring: in this case, two ploughings will be required, previous to sowing oats and clover, which will not only dispose the field to work kindly, and to lie smooth and level, so that the small fibrous roots of the clover will meet with less resistance, and the grass will form its succeeding shoots with greater facility; but this kindly disposition of the ground, at seed-time, will enable the oats, likewise, more successfully to withstand the drought of the spring, or other accidents. As it is of essential consequence that the clover-seed should be sown in a bed of well-pulverized earth, and at a time when the ground may be worked

to the greatest advantage with the harrow, care should be taken to fix on a tolerably dry time for this work, otherwise much of the seed will not vegetate, and that which may grow, will sustain infinite prejudice: for, in a wet seed-time, the ground becomes beaten down so very close, that the seed is prevented from sending forth its tender fibres: and, in consequence, from shooting forward with vigour; whence the crop languishes in its several progressive states, and fails to produce a return nearly adequate to what might have been expected from land in that improved state; and this shows the necessity of breaking up such ground, which is meant to be sown with clover-seed, in the early part of the spring, that there may be time to give the field a second ploughing, if it should be found requisite; and hence, also, appears the necessity of sowing the seed before the dry weather sets in, and this may generally be brought about, if the turnips are fed off by the latter end of February, or beginning of March. Though an early sowing, as some time within the month of March, is by far the most likely method of insuring a good crop of clover, on thin soils, yet, in the case above-mentioned, there will be no time lost in waiting till the land has been twice ploughed; though, from this circumstance, if the weather should prove unkindly, the seed-time may be protracted till April, as it will be far more prudent to wait till that time, than to sow the seed in a rough and ill-cultivated bed. Neither can such early sowing often be complied with, on stiff soils, as this stubborn ground does never work kindly under the harrow, till the spring is farther advanced; and always requires a second ploughing for the Lent corn, so that the clover is rarely sown, on these soils, till the middle of April, and very frequently this business is procrastinated till May; but this should by no means be brought into a precedent, since, on most grounds, as observed before, the early-sown clovers have a much fairer chance of succeeding, than those which are sown later in the spring."

The seeds of clover being very small, require only a superficial covering; and the usual method is to sow the clover previous to the last harrowing of the oats, by which the seed will be introduced to a proper depth; and this method of tining the seed in with the harrows, is, in his opinion, greatly to be preferred to putting it in with a bush, or only rolling in the seed, as is the practice with many people; for though this seed, being of a diminutive size, will easily take root, and, if harrowed in at too great a depth beneath the surface, would be in danger of not coming up at all; yet there is a medium to be observed, and the sowing it previous to the cross-harrowing of the corn, appears, he says, a more likely way of defending it from the casualties of the weather, than the slight covering by a bush or roller. Clover-seed is often sown amongst green wheat, in the spring, and covered with the small harrows, and the ground afterwards rolled, except when the wheat is so thin upon the ground, and so loose at the root, as not to admit of this practice, which sometimes happens; and in this case, we must content ourselves with the use of the bush, harrow, and roll.

Clover, in its infantine state, and before it has attained its rough leaf, is very apt to be eaten by the fly or flea, which is another reason for sowing early, that the plants may get into rough leaf before the approach of dry weather; and this is likewise an argument for reducing the ground to the finest possible tilth, that this insect may not have so proper a nidus to generate in; since it is found by experience, that the fly or flea, which is the same insect that preys on the seed-leaf of the turnip, and on the first shoot of the hop, is more frequently met with, and commits more fatal depredations, on ground that is rough and cloddy, than on those fields which have been reduced to a fine tilth by the harrow. There is, he says, a very common error, which farmers are apt to run into at clover-seed time, by which they are often considerable sufferers in the future crop; and this is, to sow a larger quantity of ground than they are able to harrow in the same day, so that, if there happens a glut of rain, that they cannot get on their land till several days after it has been sown, the seed must either lie uncovered, or great part of the clover be torn up by the harrow after it has begun to vegetate. It is, he says, a very usual method for the seedsman to continue sowing clover, or other grass-seeds, in the afternoon, after having sown the barley in the morning: by which management, the farmer thinks he is gaining time, as this ground may be harrowed the next day, with the odd horses, whilst the team horses are covering in the barley or oats. And, were there a certainty of fine weather, this would doubtless be a very prudent and commendable practice; but, as this is not to be depended on, it seems to him to be an experiment fraught with too much hazard, in suffering a dozen or sixteen acres of clover-ground to lie uncovered, which would be utterly spoiled if wet weather should intervene, so as to prevent its being harrowed within three or four days, a space of time sufficient for the seed to have stricken root. Nor is this the only mischief likely to follow from this practice; for the seeds of clover, as well as trefoil, being of a diminutive size, their vessels soon become overcharged with moisture; and when this happens, great part of the seed will, in course, never vegetate; so that, on every account, it seems to be highly imprudent to pursue this method, unless the weather be such as to promise a dry day or two, which, however, in our insular situation, and at this time of the year, can rarely be depended on.

Though clover-seed will grow at two years old, it is by far the most secure method, he thinks, to sow that of the last year, which is not only quicker in vegetating, but the plants likewise shoot away with greater expedition, and sooner attain their rough leaf; a consideration of no small moment, since the fly is so pestilent an enemy to this grass in its infantine state.

It is further remarked, that, in a dripping sum-

-ever, the clovers grow to a considerable height amongst the corn, and, in this case, the barley often suffers after a wet and tedious harvest. Oats take less damage by wet; and wheat, being reaped, may generally be cut above the clover. When it happens that the clover grows to so large a head during the summer, the stubbles will be found to produce great store of food, in the autumn, either for horses or cows, especially if warm dripping weather should happen at that time; and when the large cattle are removed, their places may be supplied with sheep, and by this management a very considerable advantage is gained; for thus the working horses are maintained in good heart, at a time when there will be but a small supply of green meat remaining; the cows will be supplied with a wholesome food, that will cause them to yield abundance of milk; and the fatting cattle will be greatly improved in flesh: old ewes, or, indeed, fatting sheep of whatever denomination, will thrive in this keeping; and, if they should not be perfectly ready for the butcher when taken out at Michaelmas, will, however, be in much better condition to be driven into the turnip-field, than if they had, at that time, been bare of flesh: such fatting lambs as are yet unsold, may likewise be brought into flesh on these young clovers. In short, among the various advantages to be derived from the cultivation of this grass, it is none of the least, that, in the autumn after it is sown, it will produce a supply of valuable food, which may be turned to so many different purposes, and, with the help of the saintfoine lays, preserve the turnips untouched till Christmas, if the early part of the winter should prove mild and open. To such farmers who pursue the mode of suckling lambs, the young clovers are exceedingly useful, affording a valuable pasture for the ewes, and causing them to spring abundantly in their milk. But with all these advantages, there is some discretion to be used in the feeding young clovers, both with respect to the cattle and the grass. Beasts which are of the ruminant tribe, it is well known, are apt to feed with that greediness and avidity, when turned on succulent pasture, as to occasion a repletion, which, among the farmers, is technically called hoving or blowing. Many sorts of food will occasion this malady, and none has a greater tendency towards it than clover; for which reason, the horned cattle should not be turned into the field till towards nine or ten o'clock in the morning, especially in wet weather; and whilst they are feeding, they ought to be carefully watched, though there will be less need of these precautions when they have been some few days accustomed to the food, and have eaten down the rankest part of the grass. The like precautions it will be necessary to take with respect to sheep, where they are depastured with the cows; but if these latter are not permitted to graze on the clovers till the large cattle shall be removed, they will run little or no risk of hoving. See *Hoven*. It is necessary to observe, that this, as well as other sown grasses, is much injured by being depastured too low. It will be necessary, with respect to feeding clovers in this period of their growth, to take the stock off them before the close of the year, as it would be a specimen of very ill husbandry, Mr. Bannister thinks, to suffer the cattle to remain in the field after Christmas, at which time the clover should be left of a tolerable height; for, if eaten down too close, a great part of it would be destroyed, and the spring-shoot would be languishing and weakly.

He has sometimes known young clovers mown in the circumstances above-mentioned: but this method, he thinks, would be prejudicial to the future growth of the crop, since the cutting of the stalks with the scythe must cause the juice to evaporate, and thereby weaken the stock. One advantage there is, however, which attends this practice: namely, the removal of the stubble, which, when very strong, and where the corn has been cut high, is apt to deaden the scythe at the mowing of the clover in the following summer.

In Hertfordshire, it is a common practice to sow coal-ashes, in the months of January or February, on such of the young clovers as are intended for mowing in the next summer. This is a very good practice where the land is not either fertile by nature, or much improved by the dung-cart; but where the ground is in good heart, there remains little necessity for this top-dressing on the clover. The method, with the Hertfordshire husbandmen, is to sow thirty bushels of coal-ashes on an acre, which they often fetch ten or fifteen miles, and purchase at 14*d.* or 15*d.* per sack.

Those fields of clover which are intended for pasturage, unless in very late and unkindly springs, will have attained a sufficient length to that purpose by the middle of April, and will afford store of valuable feed throughout the summer; but if it should be thought proper to reserve any part of this growth for seed, the cattle must be taken out towards the latter end of May, or early in June; and it is much more eligible to feed down those fields which are intended for this purpose, in the fore part of the summer, than to take off the primary crop for hay, as such repeated mowings have a great tendency to impoverish the land, and to render it improper for sowing with wheat the next year: besides, in the former instance, the farmer is not confined to a set time for laying-in the field, as the stock may be taken out at an early period of the summer: whereas this advantage is lost when the first crop is reserved for hay, and thus a dry time may set in, and stop the growth of the rowens, so that the crop of seed-clover will be very slight, or the ripening of the seed may be protracted till late in the autumn, when bad weather may be expected, which will greatly injure the sample.

Clover will not perfect its seeds, if mown for that purpose early in the year; therefore it is necessary to take off the first growth either by feeding or with the scythe, and to depend for the seed on those heads that are produced in the autumn. Seed-clover turns out to good account in those years when the crops are not injured by the blast, which is often fatal to them, or by the rains in the autumn, which sometimes

prove their destruction; for the time of harvesting this seed falling out late when rainy weather may be expected, renders it, on that account, a very tedious job. But where the seed has headed well, is not affected by the blast, has been properly harvested, and the sample is unadulterated by the seeds of dock, or other weeds, it proves a very lucrative article to the farmer, since it is no uncommon circumstance to grow a sack on an acre, and to sell it from 30*s.* to two guineas per bushel.

A bushel of good clover-seed, in kindly years, will weigh near 70lb. but, in bad seasons, it seldom rises higher than 65lb. Such clover-seed as is of a deep purple colour, and is free from seeds of weeds of every kind, but more particularly of dock, which, of all others, is the most pernicious, fetches a price at market out of all proportion larger than that of an inferior kind, or where the sample is adulterated with other seeds. It is, therefore, of great consequence, at the laying-in a piece of clover for seed, to be careful that the land be such that is not prone to blast, and that it be free from weeds of every description, dock especially.

It is remarked, by the author of the Present State of Husbandry, that, when it is proposed to save the seeds of red clover, the first crop of grass should be cut early, so that the second, whence the seeds are procured, may be ready for cutting by the end of August, or beginning of September. The reason of making choice of the second crop is, that it always branches out into more seed-bearing plants or stalks, than the first crop, and, consequently, a greater quantity of seed is procured from the same extent of land. Besides, the hay of a first crop of clover is more valuable than that of the second; and as it is necessary to thresh clover-hay very much, in order to separate the husks in which the seeds are inclosed, from the stems or stalks, the loss of hay is, of course, less considerable in the one case, than it would be in the other, while the crop of seed is, at the same time, more abundant. A crop of clover, of which it is proposed to save the seeds, should be allowed to stand till the husks become quite brown, and the seeds have acquired a degree of firmness. It should then be cut, and harvested in every respect like other hay; and the seeds threshed out at any period during the following winter or spring, according to the farmer's convenience. It would, probably, however, be a better and more economical practice, to have the whole threshed out immediately, while the heads of the plants are in a perfectly dry and crisp condition, as the labour would, no doubt, be much lessened. The quantity commonly reaped is from four to five bushels the English acre; weighing, when thoroughly clean, from two to three hundred weight. The expense of threshing is considerable, not less than from 5*s.* 6*d.* to 7*s.* the bushel. This great expense, which, from the laborious nature of the work, cannot be reduced, while the operation of the work continues to be performed by manual labour, may, he hopes, soon induce some intelligent mechanic to construct a machine, by which the labour may be greatly lessened, while the work may be as completely, and more expeditiously performed. See *Clover Reaping-Machine.*

It has been hinted, in the Rural Economy of the Southern Counties, that "as the great difficulty in the securing of the clover for this purpose, is that of getting the herbage sufficiently dry, in the dewy and damp season at which the seed becomes ripe; that light bags, formed of thin cloth or fine wire, might be useful for collecting, catching, and retaining the heads, which mostly rise above the herbage, by being fixed upon the handles of the scythes, as they are swept off by them, being emptied as there may be necessity; as, in this way, the herbage, by being left upon the ground, would be of three times the value of the musty straw afforded by seed-clover, either for the purpose of being eaten off, or turned down as manure. Besides, the heads, by being well dried in wet weather in the house, and in dry seasons in the open air, the seed would, it is supposed, not only be preserved with more certainty, but in a much better state in respect to the sample; and, of course, in most seasons, be of much greater value." It, notwithstanding, appears scarcely possible, however desirable it might be, to collect the heads in this way, without suffering considerable loss from their dropping down, and being lost in the herbage below, during the performance of the operation.

According to a late writer on Practical Agriculture, "the principal objections to the seeding of clover-crops, are those of their uncertainty, on account of the state of the season at which they become ripe, the trouble and expense of threshing out the seed, and the injury which they produce in lessening the fertility of the soil. The high value of the seed, in most seasons, is, however, he observes, a great inducement to the letting of clover-crops stand for that purpose."

Frosty nights, and hot, sunny, dry days, in May, are very prejudicial, Mr. Bannister says, to the clovers, and prevent a succession in the growth of those which have been eaten down, as doth likewise dry and sultry weather in June; so that, in backward springs and hot summers, the clovers produce but a trifling return, either for feeding or hay, when compared to the growth of those years wherein the springs and summers have been more kindly and propitious. During the weather above-mentioned, the stalk and leaves are often so totally scorched, that he has known, in the fields of this grass, when advanced to some height, so as to have formed the heads for bloom, and to promise fair for a crop, that the leaves have universally dropped off, and the juices have been so much exhausted by the parching heat of the sun, that the utter destruction of the crop has ensued. When this disaster happens, and the weather continues dry and sultry till the middle of June, the best way is to set on the mowers, without waiting any longer in expectation of rain, and to trust to future showers for improving the latter-math. But although on thin lands, such as gravels, chalks, &c. the clovers are often ruined by a hot and parching summer, yet on loams there is not that mischief to be apprehended from this contingency, as these grounds, being of

a stronger nature, will push on the clovers with greater vigour in their progress. This disposition in the clovers, to burn, in a dry summer, on thin soils, shows the necessity of laying them in early for the scythe, and strongly enforces the rule before recommended, not to winter-feed this grass with cattle of any kind after Christmas. Clover begins to form its head for bloom towards the middle of June, and will continue in a growing state till it becomes in full blossom, at which time it is in the highest perfection to mow for hay; but this grass differs in this particular from saintfoine, that, when its blossoms are fully expanded, they continue much longer in that state than the last-mentioned grass, so that, if the weather should prove wet and unkindly for the haying, the clovers will wait a fortnight after they become in blossom, without sustaining any material injury, either by the shedding of the leaf or bloom; for the same weather which renders it improper to mow this grass, continues it in a growing state, and prevents the blossom from dying away. When the crops of clover are large and heavy, it is necessary that the swaths should be turned over at the making, the stalks of this grass being very replete with juices. This may be done the next day after the mowing, or the second day after, as the weather is more or less favourable, observing that, as the chief virtue of this hay resides in the leaf and blossom, the less these are disturbed, the more valuable will be the fodder; on which account the tedding of this hay abroad, as is practised by some people, cannot fail to be of the greatest injury. From the wind-rows it should be made up into grass-cocks, which, having enjoyed the influence of the sun and air for a day or two, may be thrown into large cocks for carting. But if wet weather prevails during the season for making this hay, it causes an infinite deal of trouble to the farmer, and the clover, from having been frequently shaken abroad, is deprived of its most nutricious particles, namely, the blossom and the leaf. See *Hay*.

It is further remarked, by the same writer, that there is an accident sometimes happens to young clovers, which cuts off all hopes of a crop, and obliges the farmer to plough up his land for wheat. This malady takes its rise from a worm, which gnaws off the grass just within the ground, so that the blade withers and dies away. A gentleman, of great knowledge and experience in every article that relates to country affairs, assured the author, that, in December 1777, he had suffered very considerably from this insect, which, in the preceding summer, totally destroyed several acres of clover on his farm, and that this happened on the best of his land, worth more than 20*s.* per acre, whilst that of inferior goodness, and those fields which worked badly at seed-time, escaped.

Clover is rarely suffered to continue longer on the ground than one year, after which the field is generally sown with wheat, at one ploughing—a mode of husbandry exceedingly advantageous to the farmer, who thereby enjoys a crop during the fallow year, that yields him considerable profit, and leaves the ground in far better condition for wheat, than would have been the cleanest and best conducted fallow; there being no preparation so kindly for this grain, as a clover-lay. It has been long since remarked, and every year's experience confirms the truth of the observation, that clover-lays, which have been mown the preceding summer, do uniformly produce better crops of wheat, *cæteris paribus*, than those which were depastured; whereas, on the first idea, one should suppose the contrary would be the event, from a consideration that the surface of the pasture had been improved by the dung of the cattle which fed on it. This preference in favour of the mown clover, he is inclined to think, arises partly from the shedding of the leaf, which acts as a manure to the ground, but is chiefly owing to the shade which the land enjoyed during the summer, from the scorching heat of the sun, by which the nutricious particles were retained; whereas the field which has been fed down close, could participate of neither of these benefits; and, with respect to the dung of the cattle, the moisture and other nutricious matters having been exhaled by the sun, but small advantages could be derived from it. But those who keep folding-flocks, generally begin to plough up their clover-lays early in the summer, and, having ploughed one day's work, set the fold on that part; and the whole of this ploughed ground being gone over by the sheep, another journey is to be ploughed; and which business of ploughing and folding is to be continued till Michaelmas, when the whole field is to be broken up. By thus ploughing up the field at various times, a portion of feed is reserved for the stock, so long as the clover continues to grow; and the major part of it may be ploughed up some considerable time before the wheat season, whereby the ground becomes sufficiently closed, so as to guard against the ill effects of the worm; and this end is still more essentially answered by the folding, which never fails to be of great advantage, and which he is inclined to think proceeds rather from the treading of the sheep, whereby the ground is compressed to a texture more firm and compact, than from any virtue in their dung and urine, which can be of no material use in the heat of the summer: but when after seed time the sheep are folded on the ground, this is, undoubtedly, of infinite service, the invigorating moisture of the dung and urine of the sheep being immediately washed down to the roots of the grain; for which reason, this manner of folding claims a decided preference over all others, so long as the weather will admit of its being pursued.

Clover is often mown as a green fodder for the horses in the summer, which purpose it answers extremely well; and, if the land on which it is raised be in good condition, will, in a kindly spring, be fit for the scythe some time within the month of May, and may be cut twice for this use; or the second crop may be suffered to stand for seed, or be fed off, according as the farmer's exigencies may require. But since the culture of lucerne has been brought into general practice, few farmers choose to be

without a field of that valuable grass, which, in this respect, has greatly the advantage of clover, being not only equally wholesome and nutricious, but, on good land, may be mown three or four times in the course of the summer, and will remain many years on the ground. See *Lucerne.*

It is remarked, by the able writer mentioned above, that "though much advantage may be derived from the converting of clover-crops into hay, and letting them remain for seed, it is probable that a still greater benefit may be produced by the practice of cutting the crops green occasionally, as they attain a sufficient growth, and conveying them, when wanted, to the horses or other cattle in the stables and fold-yards, in order to their being consumed in the stalls. It is contended, he says, by an experienced agricultor, that, in this manner, it will certainly support more than twice the stock it would do if fed off upon the ground where it grew; and the additional quantity of manure that will, by this method, be made in the stables and yards, if they are kept well littered with any sort of straw, or even rushes or fern, will fully compensate the farmer for his expense in cutting and bringing the clover into the yards."

In instances where lucerne cannot be cultivated with success, this may, without doubt, be an advantageous system of management.

It is stated by the same author, that "it is a method which experience, in many parts of the kingdom, has proved to be of the greatest advantage, especially where the business is not upon too extensive a scale; but, in large concerns, it is, perhaps, impossible to attend to it so fully as may be necessary for deriving the greatest benefit from it." And he adds, that "the result of an experiment, stated by a writer of considerable accuracy, Mr. Young, shows, that even on an extensive scale, it is a practice which is attended with vast advantage. In this trial, seven acres of clover, cut green, were found to be sufficient for twenty horses, seven cows, five calves, and five pigs, for the period of seventeen weeks, from the middle of May. They were fed in the stable and rick-yard, being taken twice in the day to water, and the horses had neither hay or corn. In calculating the value of the crop, it is remarked, that the horses could not have been kept equally well for less than eight-pence a day; but, as the usual price at which they are taken in at, in that district, is two shillings and sixpence the week, it may be better to take that as the principle of calculation.

			£.	s.	d.
20 Horses, 17 weeks,		at 2*s*. 6*d*. per week	42	10	0
7 Cows,	ditto,	at 2*s*. 6*d*. per week	14	17	6
5 Calves,	ditto,	at 1*s*. 6*d*. per week	6	7	6
5 Pigs,	ditto,	at ———	0	0	0
			63	15	0
		Or, per acre	9	2	1

It is added, that "the quantity of dung raised by the above stock, is supposed to be from four to five hundred loads, which is estimated at 2*s*. 6*d*. per load." But "the expense in labour, for cutting and conveying the food to the stock, is not charged; which renders the experiment, in some measure, incomplete. The benefit of the practice is, however, fully established." And "the great superiority and utility of this practice is exhibited in a still more striking point of view, by contrasting this with the consumption of the same sort of crop in the field, by an equal number of the same kinds of stock; as, in the time five acres had been used in the former method, thirty had been consumed in the latter, and the horse part of the stock left in much worse condition." And, "besides the superiority of the practice of soiling this sort of crop in the economy of food, it has, the first writer observes, the important advantage, as has been seen, of affording much larger supplies of manure, especially where the stalls and fold-yards are kept occasionally well bedded and cleaned up, as the conversion of the materials proceeds, which must be greatly expedited from the vast increase in the urinary, as well as other discharges, that must of necessity take place in this mode of feeding. The principal difference between feeding clovers off on the land, and consuming them in the green state in this manner, is supposed, by Mr. Kent, to be this:—the quick growth of this grass, after mowing, shades the ground, and prevents the sun from exhaling the moisture of the land so much as it would if fed bare; consequently, it continues to spring with more vigour; and the moment one crop is off, another begins to shoot up. Whereas, when cattle feed it, they frequently destroy almost as much as they eat; and, besides, bruise the necks of the roots with their feet, which prevents the clover from springing so freely as it does after a clean cut by the scythe. In hot weather, which is the common season for feeding clover, the flies, too, are generally so troublesome to the cattle, that they are continually running from hedge to hedge, to brush them off; by which it is inconceivable what injury they do to the crop. But when they are fed in stables and yards, they are more in the shade; they thrive better; and, at the same time, consume the whole of what is given them without waste."

On this the first writer remarks, that "much of the success attending this practice, without doubt, depends on these circumstances; but, besides, the upper parts of the roots are less penetrated by moisture, and fewer of the plants, of course, destroyed. By proper attention to this crop, he says, a very useful and abundant green food, for different sorts of live-stock, may be provided at an early period in the spring, especially when the winters are not very severe. And it is advised, by Mr. Middleton, on the poorer sorts of soils, to have both the first and second crops of this plant to be eaten green upon the land by sheep and bullocks, being mown, and given them to feed upon."

In this manner, "the cattle thrive better, from their filling themselves sooner, and having more rest; and there is no waste. But in order to derive the

greatest possible advantage from this practice, with this or other crops, convenient covers, sheds, or other suitable houses, are necessary to be provided."

Since red clover has been cultivated in England, great improvements have been made in heavy clay-lands, which before produced little, except rye-grass and coarse bents; but, being sown with red clover, have produced more than six times the quantity of fodder they formerly did: whereby farmers have been enabled to feed a much greater stock of cattle than they could do before with the same extent of ground, which has, at the same time, enriched the soil, and prepared it for corn; and hence it is now common, where the land is kept in tillage, to lay down their ground with clover, after having had two crops of corn, whereby there is a constant rotation of wheat, barley, clover, or turnips, on the same land.

Mr. Donaldson considers the general introduction of clover, and other cultivated grasses, as one of the greatest improvements in modern husbandry. The commencement of improvements in the different species of live-stock, in the modes of cultivation, and in the superior quality, as well as quantity, of the crops of grain, may all, he thinks, be dated from the period when the sowing of grass-seeds was first introduced into the different districts of the kingdom.

One acre of red or broad clover will go as far, in feeding horses or black cattle, as three or four of natural grass. And when it is cut occasionally, and given to them fresh, it will, probably, go still much farther, as no part of it is lost by being trodden down.

Clover is a tap-rooted biennial plant, whose roots decay after they have produced seeds; but, by eating it down, or mowing it, when it begins to flower, it causes the roots to send out new shoots, whereby the plant is continued longer than it would naturally do.

It is stated, in the System of Practical Agriculture, lately presented to farmers, that "the practice of feeding down, or pasturing clover-crops, with live-stock, though it may be advantageous in many cases, especially where sheep-husbandry forms a principal object, always requires to be conducted with care and attention, both in respect to the plants and the animals that are to be fed upon them. As, from the tender nature of the clover-plant, it should seldom be eaten on the land by the heavier sorts of cattle, for, from the greedy manner in which they feed, many of the plants are pulled up, and others, as has been seen, greatly injured or destroyed by being bruised in their treading, especially as they protrude their young shoots. Horses are particularly objected to on this account, by many, and particularly the author of the Experienced Farmer. But where it is done, the most appropriate sort of stock is obviously that of sheep; yet where the soils are of the drier kind, the lighter sorts of stock of other descriptions, may be occasionally admitted, such as calves, foals, and young beasts. And as pigs are fond of the clover-plant, and thrive well upon it, they may sometimes be admitted with advantage. In the practice of lamb-suckling, it is an useful application of the young clovers to turn the ewes upon them, as they afford a sort of pasturage which has much effect in increasing the flow of milk. They may, likewise, in the opinion of Mr. Middleton, be applied to the fattening of sheep, in April and May, and be fed by the sheep intended for turnips, in the autumn, till they are ready, with much profit. No sort of stock should, however, be kept upon crops of clover when the land is soft, wet, or poachy." It is stated by Mr. Marshall, that, "in some of the southern districts, where it is the custom to eat down the young clovers by sheep, it is usual to choose a dry season for the purpose, the stock being removed in case the land becomes soft and wet. Where this sort of stock is employed, it may be the most safe practice not to permit the animals to continue too long upon the land; as, by eating the plants too closely, they may sustain much mischief. It is supposed by some, that treading the soil lightly, while the lands are dry, may be of great utility to the clover-plants, by forcing the earth to their roots, and in that way protecting and rendering them more capable of resisting the effects of frost in the winter-season. It has likewise been suggested, that the eating off the weak, lateral shoots, that were thrown out while under the shade of the grain-crops, may be serviceable, by increasing the strength of the plants, and enabling them to withstand the frosts, as well as to shoot more strongly in the spring." On these grounds it may, therefore, be concluded, that "the most beneficial method, where the pasturing of this crop, either in the spring or autumn, is had recourse to, is not to suffer the lands to be fed upon when in a moist state, or to be too hard stocked, or with the heavier sort of animals at any time while they are kept upon it."

In the feeding down of this sort of plant, Dr. Dickson observes, "there is, however, not only danger of injuring the plants, but the animals that consume them. Without proper management, cattle and other animals, on being turned upon them, often suffer great inconvenience, and are in danger of being destroyed by the vast distension of their stomachs which takes place. In this situation, the animals are, in the language of the farmer, said to be *blown* or *hoven*. The nature of the disease does not, he says, seem to be much investigated: but it probably arises in consequence of the large quantity of green succulent herbage being greedily devoured without due mastication, by which it undergoes an uncommon degree of fermentation in the stomach; and, from this sudden decomposition, an unusual quantity of gaseous-fluid is at once set at liberty, which ultimately overcomes the contractile power of the digestive organ, and the animal is destroyed. The supposition is, he adds, rendered more probable, from the circumstance of the affection being less apt to take place when the clovers, or other similar herbage, are fed upon in a dry state, as the stock, in these cases, are not able to consume them in so expeditious

a manner, or in so large a proportion." And that, "on these principles, the practice of not suffering the cattle, or other sorts of stock, to feed upon them when they are wet, and there is a full bite, would seem, he thinks, to be perfectly correct. The advice of not turning the animals upon the crops before the sun has dissipated the dew and moisture deposited in the night, is likewise judicious, and ought to be attended to, as well as that of keeping them in motion as much as possible when first turned in. With sheep the same precautions may be necessary, if they be put upon them with the other stock in their full growth: but when they are turned in after they have in some degree been fed down, there will be little danger of their being injured. Where the clovers are eaten off as after-grass, in their soft, foggy, and young state of growth, there is, however, great danger of the stock being hurt in this way, unless these circumstances be attended to." See *Hoven*.

It is suggested, that "the chief disadvantage of this almost invaluable plant, is that of the shortness of its continuing in the lands, especially those of the lighter and more free kinds, as has been suggested above. It is asserted by some, not to last longer than two years, except on grounds that are perfectly *fresh*; and, in some cases, where it has been often repeated, not more than one. According to Mr. Marshall, in some of the southern counties, it is, however, found more durable on the calcareous soils, especially where not frequently repeated on the same land, from its being better able to contend with weeds in its natural state of growth. These facts show the necessity of keeping it as far distant as possible in the courses of cropping, especially on all the more light friable sorts of soil, and the superior advantages of cultivating it on those of the calcareous kind. And it is suggested as probable, that its duration may be considerably prolonged, by preventing the plants from shooting up to seed-stems as much as possible, either by keeping them cut by the scythe, or by the feeding them down by stock in a moderate degree, as, in these ways, they will be prevented from being so soon exhausted in their roots as happens in many other sorts of plants, as soon as they have perfected their seeds. The frosty nights and hot dry days, in the more early spring months, as well as the close sunny weather in the summer-season, are also said to be highly prejudicial in destroying the clover-plant."

It is said to be a practice with some cultivators, "when the land is intended for the purpose of early pasturage, and, in some cases, where the object is hay, to sow rye, rib, and other similar grasses, with the clover. In the first intention, the practice may be beneficial, as the rye-grass rises early, and may contribute to afford a more full and better herbage for the stock at such periods, especially on the later sorts of soil; but, with the latter view, it should, perhaps, be seldom made use of, as the clover will, in general, produce a sufficiently abundant crop of itself; and from other sorts of plants being mixed with it, on account of their drying in an unequal manner, it may sustain injury as hay. It is, probably, for some reason of this sort, that such clover-hay as is mixed with other grasses, is less saleable, and of considerably less value in the London markets, than that which consists solely of clover. Some cultivators, however, suppose that, by blending rye-grass with clover, in a small proportion, a strength and body is given to the crop. And it has been suggested as an improvement, where rye-grass is mixed with clover, to sow the latter a week or two before the other, as, from the clover-plants having a tender weak stem in their early growth, they may in that way be prevented from being injured by those of the rye-grass clasping round and shading them. But where the crops is designed for cutting green, for the purpose of soiling animals, it would seem to be the best method not to sow any other sort of grass with it, as no advantage can be gained in that way, while injury may be produced by the practice."

It has been observed, that, "with some, it is the custom to apply manure over the clover-crop, immediately after the grain has been taken from the land, which, in soils that are not in a good state of fertility, may be advantageous, in preserving and invigorating the plants; but under other circumstances it is not necessary. There is, however, another case, in which the use of what is termed long stable-dung, when not in the state of fermentation, may be found useful, by preventing the young plants from being too closely nibbled and eaten up by sheep, which is that where the land is in the state of commonage, or an uninclosed condition. But it is supposed, that when the clovers are to be continued for two or more years, the application of a thin coat of manure, in the autumn or spring-season, is a practice from which great benefit may be derived, especially on lands that are in the less perfect state of heart. In the drier sorts of soil, this business may probably be done with the greatest advantage, about the latter end of February; but where the lands are soft, retentive of moisture, and poachy, the early part of the autumn, while the ground is sufficiently hard, may be the most suitable season for the purpose. Well-rotted dung is, perhaps, the most proper in these cases. By performing the work at this period, there is less danger, Mr. Middleton thinks, of the clover-plants dying away in the winter, than is the case under other circumstances. At whatever season the manure may be applied, it should be spread out over the surface in as even a manner as possible, and beaten perfectly fine. It is the practice, in some places, as seen above, to sow coal-ashes over the young clovers, in the latter end of January or the beginning of the following month, when they are intended to be mown in the following summer, in the proportion of about thirty bushels to the acre, by which means the crops are rendered more abundant, and the plants better preserved than could, under other circumstances, have been the case."

It has been remarked, that when clovers are kept in the state of herbage more than one year, they are not, by any means, so proper for sowing wheat

after, as in other cases; as it is the full close-smothering crops that afford the most suitable preparation for growing this sort of grain after.

White Clover, a kind of clover so denominated, from its bearing a white flower. It is likewise sometimes called Dutch clover, from the circumstance of its having been principally brought from Holland. It grows naturally in most of the pastures in England, and is generally known among the country people by the name of white honey-suckle. This is an abiding plant, whose branches trail upon the ground, and send out roots from every joint, so that it thickens and makes the closest sward of any of the sown grasses; and it is the sweetest feed for all sorts of cattle yet known: therefore, when land is designed to be laid down for pasture with an intention to continue so, it should be sown with a pretty large proportion of the seeds of this plant. There is an advantage in pasturing white clover which does not strike farmers in general, which is, that each joint of the plant furnishes a fresh root, and of course a fresh plant, whenever such joint comes in close contact with the soil; and consequently the more it is trodden, the thicker it will get upon the ground. The usual allowance of this sort of seed is eight pounds to one acre of land, but it should never be sown with corn; for, if there is a crop of corn, the grass will be so weak under it, as to be scarce worth standing; but such is the opinion of farmers in general, that they would not be prevailed on to alter their old custom of laying down their grounds with a crop of corn, though they should lose twice the value of their corn by the poorness of the grass, which in such cases will never come to a good sward, and one whole season is also lost; for if this seed be sown in the spring, without corn, there will be a crop of hay to mow by the middle or latter end of July, and a much better after-feed for cattle the following autumn and winter than the grass which is sown with corn will produce the second year. The seed of this sort of clover may also be sown in autumn, in the manner directed for the common red clover; and this autumnal sowing, if the seeds grow kindly, will afford a good early crop of hay the following spring; and if, after the hay is taken off the land, the ground be well rolled, it will cause the clover to mat close under the ground, and become a thick close sward.

White clover seed is annually imported from Flanders, by way of Holland; but it is not more a native of that country than of this, as it is very common in moist pastures, in every county in the kingdom: but the seeds were never collected for sowing in this country till of late years; nor are there many persons here, even now, who make a practice of saving this seed; though it may be done, if the same method as is practised for the red clover be taken with this sort: it therefore might be advantageous to farmers who are desirous of improving their land, to sow carefully an acre or two of this white clover for seed, which will save them the expense of buying for some years, when the price is high; and there will be a sure market for any quantity they may have to spare.

It has been greatly depended on by most cultivators in bringing lands into a state of sward, and is said to be an extremely useful plant on the more rich and dry sandy and loamy soils, as well as in the clayey and peaty descriptions of land, where they have been well drained from moisture; but on the more wet and poorer sorts of loamy and clayey lands, it is not by any means so proper or useful, as it is not lasting, but gives place to plants of the aquatic kind, as well as others of an indifferent description. It is a plant supposed by some not to afford so sweet an herbage as broad-clover, or many others; but, in our trials, it has, however, always been eagerly fed upon, both by sheep and neat-cattle, and, where closely fed down, there can be little doubt of its great utility. According to Mr. Goring, as stated in the Communications to the Board of Agriculture, that which comes up naturally by the application of manure, is much more hardy than that which is sown, as well as more lasting in the soil. And it has been justly remarked, as a proof of good land, that it runs quickly of its own accord to this plant. It may be introduced with most sorts of seeds, and contribute greatly to the success of the cultivator in the improvement of his grass-lands. The herbage, which is produced by this plant, is fine, sweet, and delicate.

Mr. Young observes, that "a very profitable article of cultivation, which has of late years been particularly attended to in Suffolk and in Essex, is that of white clover alone for seed. The first growth (contrary to the case with red clover) is seeded. Some take a spring feeding first. The returns depend, of course, on the price, which varies much, but it has proved a very profitable article, yielding from 7*l.* to 15*l.* an acre. Wheat succeeds well after it."

Hop Clover is a sort of clover bearing a yellow flower, from which it is called by some yellow meadow trefoil. It grows naturally among the grass in the upland pastures of this country; but the seeds are frequently sold in the shops, and are by many mixed with the other sorts of clover and grass-seeds, for laying down ground to pasture. This plant grows with upright branching stalks about a foot high, garnished with trifoliate leaves, whose lobes are oblong and heart-shaped, but reversed, the narrow point joining the foot-stalks. The flowers, which are yellow, grow from the side of the stalks, upon long foot-stalks, collected into oval imbricated heads, having naked impalements lying over each other like scales, somewhat like the flowers of hops, from whence the plant had the name of hop-clover. But there are two sorts of this clover which grow naturally in this country. The other is a much smaller plant than this, and generally known by the name of none-such, or yellow hop trefoil. See *Trefoil*.

This sort of clover is strongly recommended by the following circumstances: 1. Its not only growing but flourishing on the most barren sands, and therefore being a very proper grass to cultivate on such unfertile soils where any other grass that is worth notice will scarcely grow at all. 2. Its not being apt to swell cattle as the red clover does. 3.

its continuing long in good ground, and bearing a very good seed or crop; and, by its flourishing both on sands and clays which have not been ploughed for many years, its being likely to continue long in any soil.

Clover-*Lay*, the land from which clover has been taken. It is observed by Mr. Bannister, that, where clover-lays have been suffered to continue in that state longer than one year, it is a very hazardous experiment to sow the ground when broken up with wheat or oats, as from the length of time in which the surface has been covered with a turf, the worm becomes engendered therein, which often destroys the crops of corn; therefore the safest way of procedure in the breaking up these old clover-lays, is either to make a fallow of them, or to put them in with peas or other pulse. It is sometimes written *Ley*.

Clover *Reaping-Machine*, an implement contrived for reaping and collecting the heads of such clover-crops as have been let stand for seed. An engine of this sort is represented in the Annals of Agriculture.

Clover *Threshing-Machine*, an engine contrived for threshing out clover-seed.

In Bradley's Husbandry and Gardening, there is an account of a machine used for this purpose in Flanders, where the cultivation of clover was introduced at a much earlier period than in this country, which is thus described: He has seen two or three ways of threshing out clover-seeds by engines in that country, after the heads of the seeds are threshed off by common flails. The engine which he best remembers has a hopper at the upper end of a trough, so that the heads of the seeds fall constantly from the hopper into the trough. The trough is about six feet long, and about two feet and a half over, and lies slopewise from the hopper, which is at the higher end, so as to drop at the other end about a foot. The bottom of this trough, withinside, is made rough by chissels; and upon it is a board made to draw backwards and forwards, which is cut in a rough manner like the inside of the bottom of the trough. When the seeds fall into the trough at the upper end, the broad-board in its motion draws them through the trough, and thereby breaks or opens the seed-vessels, so that the chaff and the seed run out of the lower end, ready for winnowing. This motion is maintained by a water-wheel, and a crank, and answers the purpose it is designed for very well. He has also seen an engine of this kind, where the bottom of the trough was a hurdle, more finely wrought than the common hurdles; and the sliding part which he calls the broad-board, was a hurdle of the same make. In this he found that most of the pure seed fell through the lower hurdle, and little more than chaff was discharged by the lower end of the trough, and consequently must give less trouble in the winnowing or cleaning from the chaff. He has also seen another kind of mill or engine for this purpose, which somewhat resembles the mills which tanners use in grinding bark. In the former, he should have mentioned, that there is commonly a weight laid upon the upper hurdle or board, the better to break the heads of seeds that pass between that and the bottom of the trough. And from the great simplicity of this machine, the author of the Present State of Husbandry in Great Britain thinks it is surprising, that some such has not been long since erected for the purpose in England, where such great quantities of clover-seeds are annually saved. Were threshing-mills, says he, generally erected in this kingdom, it is highly probable they might in time be made not only to thresh off the heads of the clover from the stalks, but, by means of some such machinery as above described, be made also to separate the seeds from the husks. Other implements of this sort have been described by later writers on husbandry.

CLOUGH, a valley between two steep hills. It also sometimes signifies a cliff.

CLOUT, an iron plate put on the axle-tree of a cart or other carriage.

Clouted-*Cream*, such cream as is raised by means of the milk being heated.

CLUMP, a number of shrubs or trees growing together, without much shape or order.

CLUNG, closed up, or stopped; spoken of hens when they do not lay. It is also applied to wood, or any other thing that is shrivelled or shrunk up, when it is said to be clung. Ash timber is sometimes so much clung, that it cannot be split into hoops, or other similar forms.

CLUSTER, a bunch, or a number of things of the same kind growing or joined together.

Clusters, a word provincially used to imply the bunches or clumps in turnip-crops, &c.

Cluster-*Grape*, the small black grape, generally denominated currant.

Cluster-*Sowing*, that method of sowing grain in which a number of corns are placed in the ground together, or in clusters. See *Sowing of Grain*.

CLYSTER, in *farriery*, a remedy of the liquid kind, thrown by means of a proper apparatus into the rectum of an animal, for the purpose of producing a discharge of the fæces. See *Glyster*.

COAGULANTS, in *farriery*, a term applied to such remedies as have a tendency to coagulate the blood and juices of animals.

COAGULATION, a term signifying that chemical change which takes place when a fluid, or some part of it, is rendered more or less solid. This is effected in various ways, and from the different methods, as well as means, the appellations vary. Heat and cold are the two principal natural agents for coagulating fluids. Heat coagulates salts by dissipating their moisture; cold coagulates water by freezing it; water coagulates camphor, if it is dissolved in spirit of wine; spirit of wine, if pure, coagulates the white of an egg and other matters; and motion coagulates milk into butter. And, besides these, there are many other ways in which coagulation is performed.

COAGULUM, a term applied to the curdled concretion formed by the mixture of two liquors; such as the curd for cheese, separated from the serous part of milk, by means of rennet infused in warm water, &c. It sometimes also means *rennet* or

runnet; and is the concreted milk found in the stomachs of sucking quadrupeds, which as yet have received no other nourishment than their mother's milk. In ruminating animals, which have several stomachs, it is generally found in the last, though sometimes in that which is contiguous to it. If rennet be dried in the sun, and then close kept, it may be preserved in perfection for years. Not only the rennet itself, but also the stomach in which it is found, curdles milk, without any previous preparation. But the common method is, to take the inner membrane of a calf's stomach, clean it well, salt, and hang it up in brown paper: when this is used, the salt is washed off, then it is macerated in a little water during the night, and, in the morning, the infusion is poured into the milk to curdle it, a suitable proportion being made use of, according to the circumstances of the milk.

COAL, a fossile substance generally employed as fuel. Of mineral or pit-coal, there are many varieties. They appear to consist of petroleum, consolidated with an earth chiefly of the argillaceous kind. The two kinds chiefly distinguished are culm, and caking-coal. The former does not consolidate by a kind of fusion into larger masses, when heated, as the latter does, and cannot therefore be applied to such a variety of purposes.

It is observed in Nicholson's Dictionary of Chemistry, that pit-coal is usually found in strata in the earth, almost always in mountains of schistus or grit. It appears to be a general opinion, he says, that this substance owes its origin to the decomposition of vegetable bodies. And, indeed, when we attend to the inflammable substances found in the earth, or in the mineral kingdom, we may perceive that very few, and most probably none of them, can be truly said to belong to it, but have been elaborated in the bodies of animals or vegetables. From the turf that is pared from the surface of the earth, and owes its inflammability to the roots of vegetables which are mixed with it, we may descend to the peat, or black earth, of the moors, in many specimens of which vegetable remains are still perceptible; though in most they appear to be deprived of every appearance of their organic texture, their oily and inflammable nature only remaining: and from thence the transition to pit-coal is easy. For if we reflect on the vast revolutions which the earth has certainly undergone through a long course of ages, by means of which its surface has been broken, displaced, and inverted, from the actions of floods, earthquakes, and the great convulsions of nature caused by volcanic eruptions, it will be no improbable inference, that the thin though extensive strata of pit-coal, as well as the exsudations of naphtha, petroleum, and their modifications, have all arisen from the burying of extensive woody tracts of the surface, such as are common in all uncultivated countries. And this probability will be reduced to a certainty when we advert to the natural history of pit-coal, which is met with in all the various states of transformation. Whole trees are converted into pit-coal, in such quantities together as to exhibit entire forests; in which the roots, trunks, branches, bark, and even species, are discernable. Coal-pits and slate-quarries exhibit innumerable marks of impressions of leaves, and other indications of their vegetable origin; and the analysis of this combustible substance tends still further to confirm this truth. On the other hand, if we attend to such inferences as chemical theory might point out from the facts around us, we shall see, he says, how small the probability is, that the mineral kingdom should, after a certain limited time, contain inflammable bodies, if they were not occasionally thrown into it, in consequence of the operations carried on within organized substances. For all inflammable substances, tending to decompose the vital air of the atmosphere, would, in process of time, revert to the class of uninflammable bodies, if the operation of organized bodies, particularly of the vegetable kind, did not tend to disengage the vital air again, and render bodies combustible, which were not so when they became parts of those substances.

And the author of the Treatise on the Connection of Agriculture with Chemistry informs us, that fossile coal is an inflammable substance, formed of the remains of antediluvian vegetables, animal juices, and mineral or metallic substances, combined or mixed with earthy matters. Like peat, he says, it loses its inflammability by exposure to air, and becomes oxygenated. Saline compounds are thence formed; they consist of green vitriol, Epsom salt, phosphat of lime, phosphat of iron, together with earth of iron, and a proportion of the uncombined simple earths. Oxygenated fossile coal is likewise, he remarks, capable of solution by saline substances, and of producing the same good effects in promoting vegetation as oxygenated peat, when treated in a similar manner. Such coal as is most applicable for this purpose is found at the crop or outburst of most seams, particularly those which are of a soft tender nature, and easily acted upon by the joint influence of air and water. It will, he thinks, require many years before coal (wrought at a considerable depth, and brought to the surface) will, by exposure to air, become oxygenated, and attain what coal at a less depth had acquired by the action of air and water during many ages. When coal is in a state capable of being rendered soluble, it is soft and friable; when rubbed between the fingers it appears like soot; when thrown into the fire it does not burn with any flame; and, whilst consuming, emits a smell more like unto that from the combustion of peat than coal.

Most fossile coal, he says, contains the bases requisite for forming, with a combination of pure air or oxygen, the following acids, viz. the vitriolic or sulphuric, muriatic, phosphoric, &c. The acid first formed is the sulphuric. As this is generated, it combines either with the earth of iron or the earth of magnesia, forming green vitriol and Epsom salt. These salts, being very soluble, are readily washed away from the coal by rain or moisture; after which, by a farther supply of oxygen with their peculiar bases, the phosphoric and other acids are formed. These acids, as they are generated, combine with the calcareous matter of the coal, now by full decom-

position rendered capable of being acted upon, and form salts that are nearly insoluble. Oxygenated coal, when it is not found in that state, may be procured by exposing the small or refuse coal of a colliery alternately to air and moisture. This process may be much accelerated by previously grinding the coal to a fine powder.

Coal-*Ashes*, the ashes that remain after burning of fossile coal. See *Ashes*.

Coal-*Balls*, a kind of balls composed of culm, or the dust and refuse of pit-coal with mud, or some other similar material, for the purpose of being burnt as fuel. About Bristol and other places in the west of England, they commonly make coal-balls of their culm, or small refuse coal, which would not otherwise be saleable. The method of doing which is, to take a certain quantity of the culm, and an equal quantity of sleech, or mud left by the tide on the seashore: these ingredients are first mixed grossly with shovels, and then blended more perfectly with the hand; after which they are moulded into balls about six inches in diameter. Fuel of this sort may either be burnt as soon as they are made, or laid up and kept without suffering the least injury. In many places the inhabitants scarcely use any other fuel, finding it answer equally well, being much cheaper than coal, and lasting longer. These balls are the best where care has been taken to work as much culm into the sleech with the hand, when the balls will mould, as possible, without making them crumbly.

In Wales, where coal-balls are also made, they use clay instead of the sleech, allowing two parts of culm to one of clay, adding to the heap a sufficient quantity of water, with which they temper it, in the same manner as if they were making mortar with lime and sand. After the culm and clay have been sufficiently mixed and tempered together, they form the whole into balls, in the manner described above. But the balls which are made with clay are not so pleasant a fuel as those made with sleech, because the clay is apt to emit a stinking smoke, especially if the balls are burnt before they are dry, and is not of a combustible nature. But notwithstanding these inconveniences, which the lower sort of people little regard, they afford a good and cheap fuel. From the dearness of coals, a manufactory has lately been established in London for the purpose of converting the dust and refuse coal into an article of fuel, in somewhat a similar mode to that which has been just mentioned.

Coal-*Smut*, a substance of the fossile kind, a sort of efflorescence found on the surface over seams of coal.

Coal-*Soot*, that kind of soot collected in chimneys and other places where coals have been burnt.

COB, a kind of wicker basket, made so as to be carried on the arm. Hence a seed-cob, or seed-lip, is a basket for sowing from.

Cob, a term applied provincially to a round sort of stone, and sometimes to a sort of mud wall.

Cob-*Wall*, a provincial word used to denote a mud wall.

Cobs, a word provincially applied to sea-gulls.

COBBLE, a provincial term used to signify a round sort of stone found in the fields, in some districts, on ploughing them up. It also signifies a small sort of fishing-boat.

Cobble-*Trees*, a provincial word applied to a sort of double swingle-trees, whippins, or splinter-bars.

COCCIFEROUS *Plants*, such as bear-berries.

COCCULUS INDICUS, is a sort of Indian berry, or fruit, which is of a brown colour, and the size of a very large pea; rough, brittle, and, when perfect, hath a white kernel. It is brought from Malabar and the East Indies, where it grows in clusters on a large tree called *natsiatam*. It is poisonous to the human subject, bringing on fainting and convulsions. The noxious quality resides in the kernel, and it operates both as an emetic and purgative. It is only used externally, made into ointment, or infused in water. It destroys lice more effectually than the staves-acre, and may, of course, possibly be useful in the mange. Mixed with paste, it stupifies fishes, so that they will lie on the water, and not attempt to escape from the hand that takes them. It is said to be frequently made use of in small quantities by the brewers of malt liquor, in order to render them more strong and intoxicating.

COCEREL, a young cock.

COCK, the male of the hen kind; or the male of any of the smaller sorts of birds.

Cock, a word also sometimes applied to a particular kind of a draft-iron of a plough.

COCKEY, a provincial word applied to the grate over a sewer.

COCKHEADS, a term provincially applied to a weed in land, the common knob-weed, plantain, ribwort, or rib-grass. It is sometimes written *Cocks-heads*.

COCKLE, a sort of weed or grass, the same with darnel-grass. See *Darnel-grass*.

COCKLETS, a term sometimes applied to small cocks of hay, &c.

COCKS-FOOT *Grass*, a coarse rough sort of grass, which is hardy and productive. It is said to be early and useful on moist loamy soils with clayey subsoils. Sown with red clover, it forms a good sward. It grows well in the winter, and has been found useful as an early sheep-feed. It is very productive in seed. See *Ductilyis Glomeratus*.

COD, a term used sometimes for pod. See *Pod*.

CODLING, a well-known kind of baking apple. See *Apple* and *Orchard*.

COFFIN, in *farriery*, that part of the horn or hoof of a horse's foot which appears hard and firm when set on the ground.

Coffin-*Bone*, in *farriery*, that bone which lies incircled within a horse's hoof, as in a coffin. This bone is round upwards, where it receives the little pastern, but grows broader and thinner towards its bottom; it is of an open porous contexture, and is easily pierced. It is often wounded by nails, or other sharp bodies, which horses take up in the streets or roads: accidents to which they are often exposed, and which are more easily cured than they would

have been, had the bone been more hard and solid in its texture.

Coffin-*Joint*, in *farriery*, that where the lesser pastern joins the foot. When the coffin-joint is strained, a horse often continues a long time lame, without the owner discovering where the lameness is situated; because the animal does not, at first, favour it much on the bending of the foot, only in planting his foot upon the ground; but, in time, there grows such a stiffness in the joint, that he only touches the ground with his toe, and it becomes impossible to play the joint with one's hand. The only method of removing this stiffness, is by means of blistering and firing, which generally succeed, unless the stiffness and contraction have been of very long standing.

COKE, the substance which remains after pit-coal or sea-coal have undergone the process of charring. It is generally made in ovens constructed for the purpose, the fire being regulated and managed in the same manner as for charcoal.

This is a matter in an intermediate state, between that of coal and its state of reduction into ashes. It is a material that cannot, probably, any where be formed by means of the heat of the solar rays. See *Carbon* and *Charcoal*.

COLD, the privation of heat. See *Heat*.

Cold, in *farriery*, the name of a disease to which animals of almost every kind are subject, but particularly horses. It is mostly caused by an obstruction of perspiration, induced by riding horses till they are hot, and suffering them to stand in that condition where the air is cold and piercing; or removing them from a hot stable to a cold one, and too suddenly changing their clothing; hence it is that horses catch severe colds after they come out of dealer's hands; and by not being carefully rubbed down, when they come in hot, off journeys.

The signs of a horse's catching cold are a cough, heaviness, and dulness, which affect him more or less, in proportion to the severity of it; the eyes are sometimes moist and watery, and the kernels about the ears, and under the jaws, swell, the nose gleets, and he rattles in his breathing; and when the cold is violent, he is feverish, his flanks work, and he both loaths his hot meat, and refuses his water. When these last symptoms are attended with a slimy mouth, ears and feet cold, and a great inward soreness, there is danger of a bad fever. But when the horse coughs strong, snorts after it, is but little off his stomach, pricks up his ears, and moves briskly in his stall, dungs and stales freely, his skin feels kindly, and his coat does not stare, he is in no danger, and there will be no occasion for medicines of any kind; but he should be bled to about two quarts, kept warm, and have feeds of scalded bran, with as much warm water as he can drink.

In speaking of horses taking cold, Mr. John Lawrence remarks, that "some of the most common, and truly the most proper, causes are the following: new unaired stables, change of stable from warm to cold, doors or windows suddenly thrown open and continued so at unseasonable times, currents of air improperly admitted, exposure to the night-air, being suffered to stand still in the cold air immediately from a hot stable, or, when in a state of perspiration, the unnatural practice of washing horses in such a state with cold water at any season, sudden turning out to grass from warm keeping, damp body-cloths or saddle-pads."

And in regard to the prevention of the disease, he conceives it to be "the interest of every proprietor, however poor, to be provided with some kind of covering to throw over his horse's loins, on any sudden transition from heat to cold; it must also be remembered, he says, that a horse which works and runs at grass (in cold seasons more particularly) ought never to be curried, which renders his body too susceptible of impression from the air; such should only be rubbed with wisps. Should a horse take cold at grass, it is infinitely better to house him by night, in a state of moderate warmth, and allow a few mashes and warm water, from which treatment he will most probably be ready to brave the weather again, in a sound and healthy state, in the course of a few days, rather than suffer him to languish amidst the damps of the soil, with a running at the nose, which may continue for months. The usual objection to this practice is, that it induces a tender habit, which argument is also much used against clothing horses in colds; but he has always observed, that the animal body, under the influence of obstructed perspiration, is still more liable to an accession or increase of catarrh from that very account, and by no means so much so after the disease has subsided, and the vessels are less distended, which is an answer to the objection in both cases."

And he judiciously adds, that "horses which are exposed to all weathers, but which have still caught cold, and yet cannot be spared from their constant duty, ought, on the first appearance of the disease, to have clothing allowed during their labour, to lose some blood, to have nitre in their water every night, and a cordial-ball drink. This is, he says, the unfortunate description of horses which is destined to undergo all the dreadful evils of neglected and accumulated catarrh—cough, pleurisy, asthma, yellows, rheumatism, glanders, consumption," &c.

These useful directions should constantly be attended to as soon as the attack of the disease becomes evident. See *Catarrh* and *Inflammation*.

It has been further observed by the same writer, that coughs should always be attended to at first, especially in cold seasons, as by such means they will soon be removed. "A few days', or even a single day's, warm treatment in the stable, a little additional clothing, warm water, and mashes, generally, says he, do the business: the vessels, being relieved from a superfluous load, will contract, and the horse will not be liable to relapse, on exposure to the air. Spirit, or salt of hartshorn, in warm ale, sweetened with syrup of poppies, given twice a day, is an excellent medicine on the first attack of a cold; but great care ought to be had that the dose of hartshorn be not too large, lest it excoriate the throat of the

horse, and choke him. Two or three table-spoonfuls of the spirit may be given for a dose, in a quart or three pints of beer: a proper judgment may be made by the taste of the drench. Or fresh ground ginger, from two to four drachms, is an excellent substitute for the hartshorn." But "should the disease, either from neglect, the common cause, or sudden accident, be of a more confirmed and serious nature; should there be a considerable discharge from the nostrils, an inflammation of the glands under the jaws, attended with loss of appetite, medical aid must be called in, or the business may be very tedious, besides the risk of leaving in the constitution the seeds of certain of the most dangerous chronic diseases."

After bleeding, according to circumstances, he advises, in this case, to "give the following, in one or two balls, twice or thrice a day, allowing plenty of warm gruel or white water, which should be poured down with the horn, if the horse refuse it."

Take of nitre, cream of tartar, each one ounce; juniper-berries, powdered, one ounce; Spanish liquorice, melted, half an ounce, or enough to sweeten with.

Work them up with liquorice-powder, or flour, into balls.

It "may be given in gruel or ale, if a drink be preferred, and an addition made to the quantities, if required. In either of these methods, you are, he says, certain the horse has his medicine; which is by no means the case when you trust to infusions in his water, or to ingredients thrown upon or mixed with his mashes, which are frequently rejected and lost. Some horses also, with delicate stomachs, will not touch a mash in which any medicine has been mixed. There is, however, he says, great inconvenience, and even danger, in forcing any medicine down a horse's throat, when he is much troubled with a cough; and the utmost tenderness and precaution ought to be used." Care should, he says, be taken "that the cloths be not damp, or hard with dirt and sweat; in regular stables, clean washed cloths should be reserved for these occasions, or new made use of, well aired. Woollen cloth is a specific for opening the pores; the stimulus of the points of wool, according to Dr. Darwin, acting upon the skin. Should the throat be much swelled and inflamed, it will be necessary to keep the hood on in the stable; and the glands may be bathed well two or three times in the day with camphorated spirits, or spirit of hartshorn with a small quantity of oil. All possible attention should be paid to cleanliness, and straw kept in the manger to receive the discharge from the horse's nose. No hay, or other food, should be suffered to remain and become tainted with his breath. In case of damp weather, or cold searching wind, the horse ought not to stir out of the stable; but, if fine, he may be walked out an hour, in the middle of the day, well clothed, and with his hood on." He has very properly added, that, "in case of the fever running high, with violent heaving of the flanks, indicating great commotion of the blood, rattling in the throat, with loud strong cough, all cordial drenches, or balls compounded of hot seeds, ought to be avoided. Cooling, aperient, and diuretic drinks, similar to those already recommended, must be the dependence then; nor must the horse be over-burthened with clothes." The giving hot spicy drenches in this case, he says, is a frequent error of farriers in many cases.

It frequently happens that a troublesome cough remains after the other symptoms of a cold have been removed: in such cases the pectoral ball will be found useful. In violent colds, it may be necessary to bleed more than once; and, in several cases, where the symptoms were of longer continuance than usual, Mr. White gave the following mercurial ball every morning until it produced purging, with considerable advantage. Obstinate colds are said to degenerate sometimes into glanders. It is not clear how far this opinion may be true: it may be advisable, however, whenever a discharge from the nose continues longer than is usual in colds, more particularly if it comes only from one nostril, and if the glands under the jaws are swollen and indurated, to separate the horse from such as are sound, as it may prove to be the glanders:

Take of calomel, half a drachm; tartarised antimony, two drachms; powdered caraway-seeds, half an ounce. Syrup, enough to make the ball.

Cold, *Epidemical*. See *Influenza*.

COLD-CHARGE, in *farriery*, that sort of application which is commonly used for curing strains, and which generally consists of vinegar, bole, and the whites of eggs, mixed together to the consistence of a poultice, and spread over the hurt part. See *Charge*.

COLDER, a term used provincially to signify the same as stover. See *Stover*.

COLE, the name of a plant of the cabbage kind, cultivated both on account of its seed and for feeding cattle: the former being ex-pressed by mills, so as to afford an useful oil. It is also known by the title of *Rape*.

This plant has been found to thrive best in deep, rich, dry, and kindly soils; but, with plenty of manure and deep ploughing, it may be grown in others. Mr. Young says, that upon fen and peat soils and bogs, and black peaty low grounds, it thrives greatly, and especially on pared and burnt land; which is the best preparation for it.

The author of Practical Agriculture remarks, that "the soils most adapted to the culture of this plant are those of the deep and more fertile kinds: when it is grown on lands that have been long in tillage, the friable loamy kinds are found to answer the best; but it may be grown with perfect success on the fenny, marshy, and other coarse waste lands, that have been long in the state of grass, after being broken up and reduced into a proper state of preparation. As a first crop on such descriptions of land, it is often the best that can be employed. When sown on old tillage lands, the method of preparation is pretty much the same as that which has been given for the

common turnip; the land being ploughed over four or five times, according to the condition it may be in, a fine state of pulverisation or tilth being requisite for the perfect growth of the crop. In this view the first ploughing is mostly given in the autumn, in order that the soil may be exposed to the influence of the atmosphere till the early part of the spring, when it should be again turned over twice, at proper distances from each other; and towards the beginning and middle of June one or two additional ploughings should be performed upon it, in order that it may be in a fine mellow condition for the reception of the seed. But if the seed be intended to be put in upon lands that are newly broken up from the state of sward, they must, says he, be rendered perfectly clean, and in a sufficiently fine state of mold for the reception of the seed, either by frequent ploughing in the common way, and afterwards harrowing the surface well by light short-tined harrows; or by having recourse to the practice of paring and burning. The last is by much the most effectual, cheap, and advantageous method, where the surface contains a large quantity of coarse grassy matter, as it can scarcely be reduced by any other means without much time and trouble. This is the sort of preparation that is generally employed when the crop is intended to stand for seed." And that where it is "sown on the first sort of preparation, it is the best practice for it to succeed wheat or barley crops. When the former, barley or oats, with grass-seeds, may be put in after it; but if the latter, it may be succeeded to the greatest advantage by wheat, as it is found to be not only an excellent preparation for that sort of grain, but to afford it of the finest quality; and by its being taken off early, there is sufficient time allowed for getting the land in order for the wheat-crop. That where the tillage-land is not in a good state of fertility, manure of the same kind and in the same proportion as for turnips should be applied, and turned in with the last ploughing for the seed."

The author of the New Farmer's Calendar thinks, that this plant is not perhaps worth attention on any but rich and deep soils; for instance, those luxuriant slips that are found by the sea-side, fens, or newly broken grounds, where vast crops of it may be raised; hence it is, he supposes, we have heard such different accounts of its produce and use.

In the raising of this sort of crop, it is also remarked, that "such seed as has been perfectly ripened, is quite fresh, and has a fine black colour, is constantly to be preferred, as vegetating in the most perfect and expeditious manner. The quantity of seed that is made use of is, in general, from a quarter to half a peck, according to the manner of sowing that may be practised. Where the crop is intended to be consumed as a green food for animals, a larger proportion of seed may, however, be necessary than where the obtaining of seed is the chief object of the cultivator." Mr. Young mentions two quarts an acre; but some, says he, sow three, and he has heard of a gallon being used.

In regard to the sowing, it is stated that "the most common practice is that of dispersing it in as regular a manner as possible over the surface of the ground by the hand, covering it by means of a bush or other light harrow. Instead of this, it is, however, sometimes ploughed in when cultivated on the more light and open kinds of soil, a larger proportion of seed being allowed, and the furrows made narrow with but little depth. In such cases this has been suggested, by Mr. Kent, as preferable to the former mode. But the drill-method has also been practised, the seed being deposited to the depth of one inch in rows on every other land, twelve inches asunder. The superiority of this mode over that of the broadcast appears, according to Mr. Amos, to be considerable, as the land is capable of being kept clean with less difficulty and expense than in the other modes."

And "it has been suggested, by Mr. Marshall, as a desirable method to sow the seed in beds, for the purpose of being afterwards transplanted into the field, and set out in the manner of cabbage-plants. Half a rood of land in this way would be sufficient to furnish plants for five or six acres. In this manner, as well as by pulling the plants from the places where they may stand too close in the field, the vacancies that frequently occur in this sort of crop may be filled up, the work being performed by dibbles."

This Mr. Young considers as the Flemish culture. The seed should, he says, be sown thick, the plants being set out on an oat-stubble after one ploughing. "This, says he, is so great and striking an improvement of our culture of the same plant, that it merits the utmost attention; for saving a whole year is an object of the first consequence. The transplanting is not performed till October, and lasts all November, if no frost; and at such a season there is no danger of the plants not succeeding: earlier would, however, surely be better, to enable them to be stronger rooted, to withstand the frosts, which often destroy them, but the object of the Flemings is not to give their attention to this business till every thing that concerns wheat-sowing is over. The plants are large, and two feet long; a man makes the holes with a large dibble, like the potatoe one used on the Essex side of London, and men and women fix the plants, at 18 inches by 10 inches; some at a foot square, for which they are paid 9 liv. per manco of land. The culture is so common all the way to Valenciennes, that there are pieces of two, three, and four acres of seed-bed often met with. The crop is reckoned very uncertain: sometimes it pays nothing; but in a good year, up to 300 liv. the arpent (100 perches of 24 feet), or 8*l.* 15*s.* the English acre. They make the crop in July: and, by manuring the land, get good wheat."

There is also another mode noticed by Mr. Marshall, which is "the transplanting the whole crops, by beginning at one side of the field, and proceeding gradually, from one land to another, till the whole is finished, which would, it is believed, be highly advantageous; as in this way the land would be pro-

vided with the best plants, and such as are of equal size; and by their being placed at regular distances, the crops would ripen in a more equal manner, while at the same time free admission would be given to the hoe, and the intervals be kept clean by narrow horse-hoes" for the purpose. The work is commenced "about the beginning of September or October, according to circumstances, in which the plough is made use of, the plants being placed by women in a leaning position in every second furrow, about a foot apart, and the roots covered by the next furrow; after which another is added, and more plants placed in as before, proceeding in the same manner till the whole is finished. The plants of course stand at about the distance of eighteen or twenty inches by twelve. Where land that has been pared or burned is managed in this way, it is advised that the first or seed-ploughing should be in a cross direction, and that for transplanting lengthways, in order to render the land dry in the winter-season."

On these latter modes of sowing it is remarked, in the System of Practical Agriculture, that they "appear better adapted for such crops as are designed for seed, than for those intended as green food for live-stock; as, by the perfect culture that may be thus given them, and the use of manure, the inconveniences attending the feeding of rape-crops may, perhaps, in a great measure, be obviated."

And it is observed, that "when cultivated for use as a green food, the seed should probably be sown more early than where the crop is to stand for seed, or be employed in both ways; sufficiently early to get a strong leaf without running to stem the first autumn. The middle of June and the last week in July may, it is supposed, be the most proper periods." Mr. Young says, that when for sheep-feed the crop is sown all through these months; but, for seed, the first week in August will do.

Where this plant is cultivated for the seed only, it is for the most part sown on such lands as have been newly broken up, either by paring and burning, or some other means, about July or August. But where it is to be made use of as a winter and spring food for animals, the land is mostly prepared in the ordinary manner as for turnips, by three or four ploughings, according to the condition of the ground, and the seed is sown about the same time with turnips: the quantity of seed in each case is, he says, about half a peck to the acre.

According to the author of the New Farmer's Calendar, "the crop should be kept perfectly clean by means of hand and horse-hoeing, a practice which is not however by any means general among the cultivators of this kind of crop. It is supposed by some farmers, who are in the habit of cultivating this plant, that it would answer well, and pay for the labour and trouble of having the young plants transplanted, as above, from a seed-bed, a very small bed or portion of ground being sufficient to supply the necessary quantity of plants. By adopting this method, and setting them out upon ridges, as practised in some places for turnips, having a proper allowance of manure and suitable hoeing, the general complaint against the cultivation of this plant for seed might be obviated, as it is probably the weedy and slovenly state in which the crop is suffered to remain, that renders it more exhausting than many other similar crops." In whatever way the cultivation may be attempted, it is evident, from what has been observed, that land cannot be too mellow, or too much pulverized, for the cole-seed plant; for it not only requires a rich soil, but also that it be in excellent tilth.

It is remarked, that in cases of broad-cast sowing, where the after-culture "is attended to, it is the practice, after the plants have attained two or three inches in height, put out six leaves, and begun to spread and shew themselves perfectly above the ground, to hoe them over by means of a hand-hoe somewhat smaller than that employed for turnip-crops, setting the plants out to the distances of from six to eight or nine inches from each other, according to their vigour or strength, and the fertility of the soil. This is the only hoeing that is in general given; but in many cases, as where the land is poor and disposed to throw up weeds, much advantage may be derived from a repetition of the operation, not only in cleaning the ground, but promoting the growth of the plants, by stirring the mould round them. This should be done about a month or five weeks after the first hoeing. The expense of performing the work once, is mostly about six or seven shillings the acre."

But that in the row-culture, "whether by drilling the seed or transplanting the young plants, the business of hoeing may be performed in a more perfect and cheap manner, on account of the greater distances of the plants admitting the earth in the intervals to be stirred by the plough or horse-hoe, while hand-labour becomes only necessary between them in the rows. In this way a garden cleanness may be preserved in such field-crops at no great expense."

By some it is thought, that where this crop is consumed green on the soil, it is equally beneficial to the landlord and his tenant; but it is remarked in the Agricultural Survey of Middlesex, that suffering it to perfect its seed would be putting a considerable sum of money into the pocket of the tenant at the certain expense of the landlord.

It is stated, by the author of Practical Agriculture, that when "the produce is intended to be consumed as green food, the crop will, in general, be sufficiently advanced for the purpose, if there should be a necessity for it, towards the latter end of November; but, except where the seed is to be afterwards taken, it is probably a much better practice to reserve it as feed in the spring months. When cut or fed down in the autumn, the plants mostly advance so in the spring, as to form a second crop in April. But in this method of feeding off the crop, care should be taken that the plants are not pulled up and destroyed, by the animals being confined too long upon them at a time."

This crop, "as a green food for sheep, is scarcely surpassed by any other vegetable, in so far as respects its nutritious properties, and those of being agreeable to the taste of the animals; but in quantity

of produce, it is inferior to both turnips and cabbages. In this use the crops are fed off occasionally from the beginning of November to the middle of April: being found of great value, in the first period, in fattening dry ewes, and all sorts of old sheep; and, in the latter, for supporting ewes and lambs. The sheep are folded upon them in the same manner as practised for turnips: in which way they are found to pay from 50*s.* to 60*s.* the acre; that quantity being sufficient for the support of ten sheep, for ten or twelve weeks," or longer, according to circumstances.

It "has been found, by experience, to be superior to turnips in fattening sheep, and, in some cases, even to be apt to destroy them by its fattening quality." In the Corrected Report of Lincolnshire, "it is likewise observed, that, that which is grown on fresh land has the stem as brittle as glass, and is superior to every other kind of food in fattening these animals; while in that produced on old tillage land, the stem is tough and wiry, and has but little proof in it."

For sheep, this is a very fattening sort of food, highly productive of milk, and much relished by them: it must, however, be given to cattle with proper caution, as it is apt to hove and burst them in the same manner as clover. Where it succeeds, the produce of green feed in the spring is considerable; but when afterwards shut up for seed, the quantity cannot be expected so large as where it is reserved entirely for that purpose. As a winter and spring-feed, it is worth from about forty shillings to three pounds per acre, for two or three months in the spring; for which time, an acre may carry from seven or eight to ten large sheep, according to circumstances.

It has been suggested, by the author of Modern Agriculture, "that the cultivators of this crop, in order to turn it to the best account, should constantly keep in view the circumstance of its being capable of a double application: as by feeding it off with sheep in autumn, the succeeding crop may not be much injured; consequently, a large supply of winter-food be procured, without the quantity of seed being much, if at all, lessened. This is, he consequently conceives, to be the most profitable management in crops of this kind." But notwithstanding this may be the case in some soils and situations, in general there can be no doubt, but that feeding the crops lessens the quantity of seed, as a much larger produce is mostly obtained where this practice is not had recourse to.

Where the intention is to let these crops stand for seed, without feeding them down in the autumn, which is often the case, after they have been well cleaned by hoeing, nothing farther is necessary till the latter end of June, or the beginning of the following month, when the seed begins to become ripe.

It is observed by Mr. Donaldson, that where this kind of crop is cultivated for seed, great care should be taken that the crop be not allowed to remain too long uncut; as, in that case, it is very apt to shed its seeds. As soon as the pods begin to assume a brownish colour, it should be reaped, and laid carefully on the ground, in the grips or reaps, where it ought to remain, without moving, till it be ready for threshing. This is ascertained by the straw or stalks becoming white, and the seed, when rubbed out, appearing black. It should always be threshed on the field on which it grows, as it is almost impossible to move it to any distance without shaking out a great part of the seed. The operation is performed on large cloths, about twenty yards square; and, in order to do it expeditiously, a great number of hands are commonly employed.

It is observed by Mr. Young, in his Calendar of Husbandry, that "crops of rape or cole-seed are extremely various, uncertain, and subject to many misfortunes; they must be conducted with great spirit, or the loss will probably not be small. The principal point is to make good use of fine weather; for, as they must be threshed as fast as reaped, or at least without being housed or stacked, like other crops, they require a greater number of hands, in proportion to the land, than any other part of husbandry. The reaping is very delicate work; for, if the men are not careful, they will shed much of the seed. Moving it to the threshing-floor is another work that requires attention: the best way is to make little waggons, on four wheels, with poles, and cloths strained over them: the diameter of the wheels about two feet; the cloth-body five feet wide, six long, and two deep, and drawn by one horse; the whole expense not more than 30*s.* or 40*s.* He has, in large farms, seen several of these at work at a time in one field. The rape is lifted from the ground gently, and dropt at once into these machines, without any loss: they carry it to the threshers, who keep hard at work, being supplied from the waggons, as fast as they come, by one set of men, and their straw moved off the floor by another set; and, many hands of all sorts being employed, a great breadth of land is finished in a day." Some use sledges prepared in the same way. "All is, he says, stopped by rain, and the crop much damaged; it is, therefore, of very great consequence to throw in as many people as possible, men, women, and boys, to make the greatest use of fine weather."

The seed "is, likewise, sometimes cleaned in the field, and put into sacks for the market. But when large quantities of seed are brought quickly together, as they are liable to heat and become mouldy, it may be a better method to spread them out thinly over a barn, granary, or other floor, and turn them as often as may be necessary." It is stated, that "in some parts of Yorkshire, this business formerly constituted a sort of festival; but, at present, is much on the decline, the method of binding the crop in small sheaves, and stacking it in the field, being much adopted. The barn ought, however, to be preferred." In respect to the "expenses of the different operations, such as reaping, turning, threshing, dressing, and depositing the seed in bags, they may, in general, be estimated at from 25*s.* to 30*s.* the acre."

In cultivating these crops for seed, great care

should be taken to keep the birds from them, as otherwise they will soon destroy a greal deal.

The produce is various, according to the difference of culture which the crop has undergone, and the manner in which it has been managed in procuring the seed.

It is further remarked, by the writer just mentioned, that cole on which sheep have been folded, is in many places allowed to stand afterwards to perfect its seed—a practice which cannot, however, be recommended, but in cases where it has been slightly eaten off. This is particularly the case, he says, in Northamptonshire, as is evident from the following passage in the Report of the present State of Agriculture in that district:—"Cole, or rape, is cultivated as a spring-food for sheep. The sheep are folded in the same manner as on rye and turnips, and continue till about the end of February. If the winter be favourable, and not very wet, the cole is sometimes allowed to stand for seed, when thirty bushels, on an average, are produced on the acre. This article varies very much in price, from 18*l.* to 35*l.* the last." As there are ten quarters, or eighty bushels, in a last, the price of this seed may be said to vary from 4*s.* 6*d.* to 8*s.* 9*d.* the bushel, according to the prices above-mentioned; and from 6*l.* 15*s.* to 13*l.* 2*s.* 6*d.* by the acre; average 9*l.* 18*s.* 9*d.* Cole, when it thrives, and the seeds are well preserved, is, he thinks, one of the most profitable crops known in England. It is, at the same time, extremely precarious; being, like turnips, very liable to be destroyed by swarms of flies and insects. And from what has been observed above, it is obvious, that uncommon care and attention is necessary in harvesting this sort of crop. If it be not cut down at the proper time, or if a long-continued fall of rain should happen immediately afterwards, the crop is in great danger of being entirely lost.

It has, however, been observed, that where the plant "succeeds well, and the season is favourable for securing the seed, the crops are extremely profitable to the cultivators, forty or fifty bushels or more being frequently produced on the acre. Mr. Marshall thinks, indeed, that, on the whole, it may be considered as one of the most profitable crops in husbandry. There have been, says he, instances, on cold unproductive old pasture-lands, in which the produce of the rape-crop has been equal to the purchase value of the land. The seed is sold by the last of ten quarters, for the purpose of having oil ex-pressed from it, by mills constructed for that use. The price varies considerably, but has lately seldom been much below thirty pounds the last.

"The culture of these crops for seed has been much objected to by some, on account of the great degree of exhaustion of the land that it is supposed to produce; but where it is grown on a suitable soil and preparation, with proper attention in the after-culture, and the straw and offal, instead of being burnt, as is the common practice, converted to the purposes of feeding and littering cattle, it may, in many instances, be the most proper and advantageous crop that can be employed by the farmer."

It is remarked by Mr. Marshall, in his Rural Economy of Yorkshire, that "the value of the straw to cattle in winter is very considerable. The *stover* (pulls and points broken off in threshing) is as acceptable as hay, and the tops are eaten with an avidity nearly equal to cut straw, better than wheat-straw. When well got, the smaller butts will be eaten up clean. The offal makes excellent litter for the farm-yard, and is useful for the bottoms of mows, stacks, &c."

The haulm of this plant is frequently burned; and, in some places, the ashes, which are equal to pot-ash, are sold; by which practice, if no manure be substituted, the soil must be greatly deteriorated. It is a custom, in Lincolnshire, sometimes to lay their lands down with cole, under which the seeds are found to grow well. But this sort of crop, as has been already observed, is most suited to fresh broken-up or burned lands, or as a successor to early peas, or such other green crops as are mowed for soiling cattle.

This kind of plant is sometimes cultivated under the name of rape. See *Rape*

COLEWORT, a plant of the cabbage kind, formerly more cultivated in the field than at present, cabbage-plants being substituted in its room. It might, however, be a very useful plant for feeding milch cows, or other cattle, in the spring, when there is a scarcity of green food, as it is so hardy that the frost does not destroy it.

The most advantageous method of cultivating this plant in the field, is that of sowing the seeds about the beginning of July, choosing a moist season, by which the plants may be brought up in about ten or fourteen days: the quantity of seed which is necessary for an acre of land, is generally about nine pounds. When the plants have got five or six leaves, they should be hoed in the same manner as turnips, cutting down all the weeds from among the plants, and also thinning the plants where they are too thick; but they should be kept thicker than turnips, because they are in more danger of being destroyed by the fly: this work should be performed in dry weather, that the weeds may be killed. About six weeks after, the plants should have a second hoeing, which, if carefully performed in dry weather, will entirely destroy the weeds, and make the ground clean, so that they will require no farther culture. In the spring, they may either be drawn up, and carried out to feed the cattle, or the beasts may be turned into the field to feed upon them as they stand; but the former method should be preferred, because there will then be little waste; whereas, when the cattle are turned in among the plants, they tread down and destroy more than they eat, especially when they are not fenced off by hurdles. By sowing the seeds in rich beds of ground, and afterwards removing the plants into the field, in the way that cabbage-plants are managed, the produce of this vegetable might probably be rendered more abundant.

COLIC, in *farriery*, an affection of the intestinal canal, arising from a variety of causes, and attended with excruciating pain. See *Gripes*.

COLLAR, that part of the harness of a draught-horse, or other animal, that goes round his neck, and rests on the shoulders. For horses, they are mostly made of canvas, &c. stuffed with hair, tow, or straw, and covered with leather. Too little attention is frequently bestowed in the construction of these articles; as it often happens that, from some roughnes or inequality on the surface, or for want of fitting properly, that the pressure becomes unequal, and not only causes pain, but produces blemishes, and sometimes lameness. These circumstances should, therefore, be well attended to.

It is observed by Mr. Marshall, that after trying different experiments with collars made in various shapes, and finding those formed with hair and tow prevented a tender-shouldered horse from galling, but were tedious, expensive and complex; he contrived one made with a wooden bolster; and instead of the bottom piece substituted an iron spring bow; and instead of spring pins had catches. The idea of a wooden collar was suggested from this circumstance: when a horse galls, it generally proceeds from some knot or lump in the stuffing. He prefers straw ones, as, be the straw collars ever so hard, if they be smooth they seldom gall. He used the same wooden collars with great success for oxen, conforming to the construction of the shoulders of them, which are generally very much concave, not convex. On experience, he strongly recommends the nine-pin collars as preferable to the bolstered ones for an ox, as they have this material advantage: whether the ox draws on a straight line, or turns on the curve, they are equally easy on the shoulder. This is not so perceptible at plough, where it is straight forward, as at cart; when they draw at the turnings, and where they obviously draw against the outer edge of the bolster. Besides, the nine-pin collars take less wood, are easier made, stronger, and more sightly, and they fit a hollow as well as a full shoulder. Representations of these different collars may be seen in *plate* III. in the second volume of "Minutes of Agriculture in the Southern Counties."

Collar *of Brawn*, the quantity of brawn usually bound up in one parcel. See *Brawn*.

COLLATERAL *Bee-Boxes*, a term applied to a particular sort of bee-box. See *Bee-Boxes*.

COLLEY *Sheep*, such kinds of sheep as have black faces and legs. The wool of these sheep is generally very harsh, having hairs mixed with it, and not so white as that of other sheep.

COLONY, a collection of people drawn from a country to inhabit a distant place. The term has also been applied to a stock of bees. See *Bee*.

COLOUR, the peculiar discriminating appearance in the hides or coats of animals. It varies greatly in different sorts of beasts, as well as in those of the same kinds or tribes. In the cattle kind, the most predominant colours are those of the black, white, red, brown, and dun; but they are likewise often mixed, as spotted, brindled, or flecked. The most hardy colours are said to be the blacks, reds, and browns.

Colour *of Horses*, in these it is also equally various. It is a disputed point among farriers, whether the colour of a horse, or of any other domestic quadruped, is any indication of excellence or of defect. Gibson, whose experience and knowledge of the horse cannot well be disputed, says, that "not only much of the beauty of a horse depends upon his being well marked, and of a good colour, but also that his good or bad properties are sometimes denoted by his being of this or that colour, or his having such and such marks." He, however, adds "these appearances are not *always* to be depended on, for daily experience teaches us, that, however true these observations may prove in the main, yet we often meet with good horses that are very ill marked, and of bad colours; and sometimes very bad horses that have almost all the beauty that colour and marks can give them."

The principal colours of horses are the *bay*, the *chesnut*, the *black*, the *brown*, the *dapple-grey*, and *sorrel*. The white is for the most part originally grey, which turns sooner or later into white, as his limbs happen to be lighter or darker; for the light grey colts, that grow the soonest white, have generally little or no dark mixture about their joints.

In regard to the *bays*, perhaps so called from their resembling the colour of dried bay-leaves, they are of various degrees, from the lightest bay to the dark, that approaches the nearest to the brown, but always more shining and gay. The bright bay is an exceedingly beautiful colour; because a bright bay horse has often a reddish dash, with a gilded aspect, his mane and tail black, with a black or dark list down his back. Also the middle colours of bay have often the black list, with black mane and tail. And the dark bays have almost always their knees and pasterns black; and we meet with several sorts of bays that have their whole limbs black from their knees and hocks downwards. The bays that have no list down their backs are for the most part black over their reins, which goes off by an imperceptible gradation from dark to light towards the belly and flanks. Some of these incline to a brown, and are more or less dappled. The bay is one of the best colours, and horses of all the different kinds of bays are commonly good.

And the true *chesnut* is generally of one colour, without any shade or gradation: his hairs are often compounded of three colours, the root light, the middle dark, and the points of a pale brown, which make an agreeable mixture, and differ from the sorrel in this, that the mixture of the chesnut is not so distinct and apparent to the eye, especially at any distance, because the hairs of the sorrel are often of several colours intermixed, wherein the red or fox colour generally predominates. Many chesnut horses have their manes and tails very near the colour of their bodies; many of them have but little white about their legs, and frequently no mark, whereas the sorrels have generally a good deal of white about

their legs and pasterns; many of the sorrels have a large blaze, and not a few are bald all over the face, while their manes and tails are sandy or of a flaxen colour. Both the chesnut and sorrel are of degrees darker and lighter, and there are some chesnut horses with manes and tails as light as the sorrel, and the hair all over their bodies approaching towards a fallow colour, only with a sort of beautiful chesnut stain. There are many good and beautiful horses both of the chesnut and sorrel; but the latter, when they have much white about their limbs, are apt to be more faulty in their feet than those that are more uniform in colour, and they are also apt to be more tender in constitution. Most people prefer the chesnut to the sorrel, both in point of beauty and goodness in most respects.

With regard to the *brown*, it is a colour not altogether so beautiful as the bay or chesnut. Horses have also their degrees, some being light, and some very dark. They have almost all black manes and tails, and often their joints are black, though not so shining as the bays, but rusty. Almost all brown horses grow gradually lighter towards their bellies and flanks, and many are light about their muzzles. The most beautiful are those that happen to be finely dappled, for the plain browns are esteemed more ordinary. Many of them are coarse, but strong and serviceable, fit for draught, for burden, or for the purposes of war.

The *black* horses are very beautiful, especially when they are of a jet shining black and well marked, and have not too much white. For, as a great deal of white, especially when it spreads round the eyes, and a great way up their legs, adds nothing to their beauty or goodness. The English black horses have more white than the black horses of any other country. The above writer says, he knew many fine Spanish horses, some Arabs, and one Egyptian (the only one he ever saw of that country), all without any white. The Dutch and Danish horses seldom have much; though he thinks a star or blaze, and sometimes a white muzzle, and one or more of the feet tipped with white, beautiful, and no diminution to the goodness of a horse. Some black horses have brown muzzles, are brownish on their flanks and between their hips. These are often called black browns, as they are not a perfect black, but approach near to the colour of a tawny-black hound; some are of a lighter colour about their muzzles, and are called mealy-mouthed horses; and of this sort are the pigeon-eyed horses, which have a white circle round their eye-lids, and their fundaments often white. He says he found many of the English black horses, especially of the largest breed, not so hardy as the bays and chesnuts, &c. Those that partake most of the brown are generally the strongest in constitution.

In respect to the *greys*, they are so diversified in colour, and so common and well known, that it would be a needless labour to describe them particularly. The dappled-greys are reckoned the best, and are to be found in most parts of the world. The silver-grey is extremely beautiful and many of them very good. The iron-grey, with light mane and tail, have also a gay appearance, but are not accounted the most hardy. The light plain grey and the pigeon-coloured grey soon change and turn white, as all other greys do in process of time. The dappled-grey keeps his first colour the longest, which is a sign of strength and durableness. Some of them have become pretty old before they have changed, and never so perfectly as not to retain some vestiges of their native colour. The nutmeg-grey, where the dapples and other mixture participate of the bay or chesnut, is not only exceedingly beautiful, but most of the nutmeg-coloured horses turn out very hardy and good for service.

As to the *roans*, they are a mixture of various colours, wherein the white predominates. Many of them turn out much better than they appear to be. Some are exceedingly good, and those that have a mixture of the bay or nutmeg-colour are sometimes tolerably handsome. They have a general resemblance to each other, and yet a very great diversity: some are strewed over with white as if they were powdered or dusted with flour, and some as if milk had been spilt all over their buttocks; others, as if they were powdered with soot or lamp-black, and some as if their faces had been dipped in a bag of soot. Many of these are good road horses, and hardy in their disposition.

The *strawberry* approaches pretty near the roan in some respects, but in most resembles the sorrel, being often marked with white on the face and legs, which is seldom observed perfect without mixture on the roan. The bay mixture in the strawberry is also of the highest colour, and makes him look as if he was tinctured with claret; some of this sort are handsome and good, but not common.

And the *fallow-colour*, the *dun*, and the *cream-colour*, have all one common resemblance, most of them having a list down their backs, with their manes and tails black. The mouse-dun and lead-colour are the most ordinary; and, from the list down their backs going off with a soft imperceptible shade, like what is observed on the back of an eel, are called eel-backed. Few people choose dun-horses, though horses of this colour often prove useful.

The fallow and cream-coloured horses are many of them good and beautiful. Those are generally the best that, besides their manes and tails, have their muzzles and their joints black or chesnut, and their colour a little inclined to chesnut. Gibson asserts, that he has known some with manes and tails of a *silver* colour, not only extremely beautiful, but very good and useful. The fallow and tawny duns are often shaded with a darker colour, and sometimes faintly dappled, and look very fine in a well matched set. Besides these, there are many other colours, as the *peach-colour*, *starling*, and *flea-bitten*, &c. but they all participate more or less of some of the colours just mentioned. It is remarked by Mr. Lawrence, that " all he is warranted in saying, from his own observation, is, that he has seen more bad horses of all kinds among the *light bays*, with *light-coloured legs and muzzle*,

than amongst any other colours; and the most good saddle and coach-horses among the common bays, with black legs and manes, and the chocolate browns." But that this, in all probability, has been accidental.

COLT, a term applied to young horses.

It has been remarked by the author of the Treatise on Horses, that "in order to rear valuable stock, either for use or sale, it is necessary to give the colts corn immediately from weaning, and during every winter. It is also of the utmost consequence that they have good shelter from cold, wet, and storms, in hovels or out-houses, moderately littered down. Low keep and damp lying produce a poor and watery blood, and are by no means favourable to growth, or that plumpness of the muscles, which so materially conduces to substance, strength, and symmetry. A quarter peck of ground oats per day, with good hay, or even plenty of good oat-straw, is excellent keep the first winter for a colt. The only substitute for corn is fine pollard or carrots; of the latter, a yearling will eat a peck per day, sliced thin. Foals should be weaned by the beginning of November, if the mare be in foal; if otherwise, they had better suck all the winter, the dam being high fed, and the foal sharing with her. A caution, however, is necessary to those who feed foals as if they intended to bacon them: of this description was that worthy old farmer, of whom he has somewhere made honourable mention; he would sometimes feed a colt stone-blind by the time it reached its third year."

And he thinks "it is of consequence to be remembered, that yearlings will frequently suck the mares, and very much injure the young foals. Foals are often griped by the milk, either on account of its being heated by the mare's labouring, or its quality being affected by sour and bad herbage. Warm mashes of fine pollard and bran are in this case useful. If necessary, a small quantity of sulphur, magnesia, and honey, may be added. Sucklers are also occasionally liable to be hide-bound, dull, and inapt for motion. They will be sometimes costive, then loose, the excrement securing from them in small quantities. It arises, on most occasions, from the imperfect digestion of bad milk. Balls of fine rhubarb and magnesia, equal quantities, made up with honey and the sifted meal of oats, are the proper remedy, and must be used as necessity requires, until the colt be weaned. From two to four tea-spoonfuls make a dose, and care ought to be taken that the ball be not too large."

In weaning young colts, they should be kept in a clean stable, not over warm, which is apt to render them tender, and too sensible of the impressions of the air. They must frequently have fresh litter, and be rubbed often with straw; but not tied or curried till they are three, or at least two years and a half old: as the roughness of the friction would give them pain; and their skins being tender, instead of its contributing to their thriving, it would be more liable to make them fall away. The rack and manger should not be too high, lest the necessity of lifting up their heads to reach their food should occasion them to carry their heads in that manner, which would spoil their chests. When they are a year, or a year and a half old, the hair on their tails should be cut, as from it the succeeding growth will be stronger and thicker than the former. The colts should be kept in a separate place from the fillies after they are two years old; and at the age of three years, or three and a half, they should be broken and rendered docile. In order to this, a light easy saddle should be put on their backs, and continue there three or four hours every day. They should also be used to receive the bit of a small bridle into their mouths, and suffer their feet to be taken up, and some strokes given to the sole, as if shoeing them. If they are designed for draught-horses, harness should occasionally be put on their bodies, and afterwards a snaffle-bridle added: They should then be trotted on level ground, but without a rider, the person only holding the reins, and either the saddle or harness on their backs: and when the saddle-horse easily turns, and freely comes up to him that holds the rein, he should mount his back, and dismount again immediately, without riding him, till he is four years old, as before that time the weight would be too much for him: but at four years old he may be ridden, and trotted at small intervals. See *Foal* and *Horse*.

Colt-*Foal*, a foal of the male kind. See *Foal*.

Colt-*Evil*, in *farriery*, a distemper to which young horses are subject, consisting of a swelling in the sheath, occasioned by their having too much liberty with mares before they are able to cover them. This disease may, generally, be readily removed at the beginning, by the use of cold saturnine fomentations, &c. but if the swelling be hard, and much inflammation appear, bleeding and purging may be necessary; and it may also be proper to confine the yard, by means of a suitable bandage, leaving a hole for the urine to pass freely.

COLTS-FOOT, the name of a very common plant, whose scaly stalks arise in February, bearing one yellow compound flower, which is succeeded by a hairy white down. The leaves come out later. They are shaped somewhat like a horse's hoof, and are downy underneath. This weed, which delights to grow by the side of rivers, increases so fast by its seeds and rambling roots, every piece of which last will produce a new plant, though they have been broken by the plough, that it cannot be extirpated without much difficulty, and a considerable time. Carefully pulling up the roots every time the earth is stirred, or wherever the least vestige of the plant appears, and preventing its running to seed, are the most effectual means of destroying it in arable land; and this, in such cases, is best accomplished by means of frequent hoeing and good tillage; but in order totally to extirpate it, the ground should be laid down long to grass. It has sometimes been nearly destroyed by two crops of vetches; and Mr. Lisle is clearly of opinion, that it may be killed by letting the land lie a sufficient time under clover or rye-grass; because the roots of the natural grass matting more and more every year, will in five or six

years so bind the surface of the ground, that the colts-foot will not be able to pierce through it, and will therefore die. He ploughed up broad clover in the beginning of July, and turned up the roots of colts-foot, in which he observed, below the earth, many little buds shot forth, of the bigness of the midsummer buds in fruit-trees, to be probably the leaves or flowers of the next year; and at the depth of five, six, and even seven inches, he remarked here and there a shoot of a callous body, like the root itself, from one to four inches long; perhaps destined to be the future roots. He experienced that a winter's fallow will not destroy these roots, but that they cannot resist the effect of summer fallows, in which they are turned up and exposed dry to the sun. It is therefore necessary to pick them as clean as possible, and burn them: for it is not to be supposed, that all the roots which are turned up, in a summer fallow will wither of themselves; on the contrary, such of the buds at the joints of these as are buried under ground will shoot out again if much rain falls, or the season be wet.

COMB, a measure of corn, usually consisting of four Winchester bushels; but in some of the fen districts it consists of four bushels, and each bushel of eight gallons and a quart. It is sometimes written *Coomb*.

COMINS, a provincial word signifying commonage.

COMMON, an open piece of ground made use of equally by different persons, who occupy land in the parish to which it belongs.

It is observed by Mr. Donaldson, in his Present State of Husbandry in Great Britain, that in all the open field parishes, where the same arrangement continues as was at first established, there is a considerable extent of common field allotted for the pasturage of the live-stock belonging to the inhabitants. These, generally, consist of such lands as are less fit for the plough, or more distant from the town or village. The parish commons are for the most part divided into three fields; one for the pasturage of the horses, another for the neat-cattle, and the third for the sheep. The horses are generally tended by one of the farmer's servants. The whole of the sheep belonging to the parish are put under the charge of a common shepherd, who is hired at the general expense; and the cows and young cattle are taken care of nearly in a similar manner. When the inhabitants of several adjoining parishes possess rights of common pasturage on an extensive common, as is frequently the case, particularly in the counties of Middlesex, Surry, Northampton, and other districts in the middle and south parts of the kingdom, the whole of the horses, cattle, sheep, hogs, &c. which are sent to the commons, are committed to the care of one or more persons appointed for the purpose. In some cases the right is limited; or, as it is called, stinted. When that is the case, such a number of cattle only, as the straw and hay growing on the farms will maintain in winter, is permitted to pasture these commons in summer. And, therefore, each farmer is, by particular laws, prevented from sending above a certain number, which is regulated, partly by the extent of his farm, and in some cases by the title on which he claims a right of commonage.

But when the common is unstinted; or, in other words, where the farmers possess a right of pasturing any number and species of live-stock which they choose to send, and without restraint of any kind, the value of such right is considered by many farmers as so inconsiderable as not to be worthy of their attention. Such farmers as possess improved breeds of horses, cattle, and sheep, seldom, indeed, if ever, send any of them to be pastured on the commons, whether stinted or unstinted. They generally dispose of their right for a trifle, to some neighbouring farmers or dealers, who have no objection, in the view of profit, of running the risk of their cattle meeting with accidents, or being infected with diseases, as must naturally be expected to happen on these extensive commons, where so many cattle are promiscuously collected together.

It is remarked by Mr. Middleton, that the commons in Middlesex, as in most other places, are three-fourths of them covered with heath and furze, from which a little of the worst sort of firing is obtained by the poor. The trifling quantity which cattle consume from these shrubs does not, and indeed cannot, improve them, as it is barely sufficient to keep them from starving. Much of the remainder is occupied by roads, gravel-pits, and ponds, yielding nothing. After the most mature consideration, he is inclined to think, that about 5,500 acres of the commons in the above county are employed in the production of grass for the feeding of cattle, affording indeed but a miserable pasture, as the greater part is under water during winter; and, from being poached and trodden down by cattle while wet, is rendered hard, lumpy, full of holes, and partakes of the sterility of mortar during summer. The grasses are mostly of the dwarf kind, and of scanty produce, with a larger proportion of the carnation and other grasses, which are known to be rather more dangerous than nourishing; so much so, as to induce some of the most observing farmers in various parts of the kingdom, possessing extensive common-rights, after a fair trial, to refrain altogether from turning their cattle on such commons. On such authority it may well, he says, be questioned, whether commons are of any more use to the community than they would be were they consigned to the bottom of the deep. But without attempting the solution of such a question at present, he may be allowed to observe, that the value of commons, considered solely as to their power of increasing animal food, and as totally unconnected with the adjoining inclosures, is extremely small indeed. But when considered as affording an opportunity to the neighbouring farmer to turn his stock out, at certain seasons of the year, they become an object of some importance. For instance, in the spring quarter of the year, by receiving the stock during those months, the growth of hay is encouraged, they answer the purpose of pasture, and the farmer is thereby enabled to mow all his inclosed

grass-land; which must sensibly increase the quantity of hay to be sent to mark.t, as at Finchley, and Harrow-weald, in this county; or being applied, during the winter months, to the support of a greater quantity of live-stock, in places more distant from a good hay-market; and in others, for the purpose of folding on the arable land.

On estimating the value of the commons in the same county, including every advantage that can be derived from them, in pasturage, locality of situation, and the barbarous custom of turbary, it appears, he says, that they do not produce to the community, in their present state, more than four shillings per acre! On the other hand, they are, in many instances, of real injury to the public, by holding out a lure to the poor man—the means of materials wherewith to build his cottage, and ground to erect it upon; together with firing, and the run of his poultry and pigs for nothing. This is, of course, temptation sufficient to induce a great number of poor persons to settle upon the borders of such commons. But the mischief does not end here: for, having gained these trifling advantages, through the neglect or connivance of the lord of the manor, it unfortunately gives their minds an improper bias, and inculcates a desire to live, from that time forward, without labour, or at least with as little as possible. The animals kept by this description of persons, it is soon discovered by their owners, are not likely to afford them much revenue, without better feed than the scanty herbage of a common. Hence they are tempted to pilfer corn, &c. towards their support: and, as they are still dependent on such a deceptious supply, to answer the demands of their consumption, they are in some measure constrained to resort to various dishonest means, so as to make up the deficiency.

Another very serious evil which the public suffers from these commons is, he observes, that they are the constant rendezvous of gipsies, strollers, and other loose persons living under tents, which they carry with them from place to place according to their conveniency. Most of these persons have asses, many of them horses, nay, some of them have even covered carts, which answer the double purpose of a caravan for concealing and carrying off the property they have stolen, and also of a house for sleeping in at night. They usually stay a week or two at a place; and the cattle which they keep serve to transport their few articles of furniture from one common to another. These, during the stay of their owners, are turned adrift to procure what food they can find in the neighbourhood of their tents, and the deficiency is made up from the adjacent hay-stacks, barns, and granaries. They are known never to buy any hay or corn, and yet their cattle are supplied with these articles of good quality. The women and children beg and pilfer, and the men commit greater acts of dishonesty. In short, says he, the commons of this county are well known to be the constant resort of footpads and highwaymen, and are literally and proverbially a public nuisance. And that they are so in the more distant counties is evident from the Gloucester and Hereford Reports of the State of Agriculture. There are also many additional injuries which commons render to society.

That the commons of Middlesex, says he, are capable of being improved, so as to produce large crops of all the vegetables usually cultivated, and to rear and support a very highly-improved breed of cattle, there can be no sort of doubt. Indeed, it is truly lamentable to see, in every part of these kingdoms, such extensive tracts of land lying waste or uncultivated; producing no revenue to the owners of such property, and extremely doubtful if any, the smallest, benefit to the community. But it is particularly disgraceful to this, the first and principal county, which, so far from raising a sufficient supply of bread for its inhabitants, is under the necessity of importing corn from every quarter of the world (Europe, Asia, Africa, and America), while, at the same time, it has so many acres of good land lying waste, and locked up from the operation of the plough. By the single means of inclosure, an abundant quantity of corn might be produced, and 150,000*l.* a-year added to the wealth of the county, which is now absolutely lost to society, with as careless an indifference as if the proprietors of the soil were afraid of becoming too rich; or, as if, like the dog in the manger, they would not permit the community to share in a blessing of which they themselves are not inclined to partake. The benefits and advantages that would be derived from a general inclosure of commons are so numerous, as far to exceed his powers of description or computation. The opportunity it would afford of separating dry ground from wet, of well draining the latter, and liming the rotten parts, is of infinite consequence; as such an arrangement would, with the aid of intelligent breeders, be the means of raising a breed of sheep and neat-cattle far superior to the present race of wretched half-starved animals now seen in such situations. It would have the effect of supporting a more numerous stock upon the same quantity of food, by restraining the cattle and sheep within due bounds. Their restless and rambling disposition not only treads the grass off the ground, but also takes the flesh off their bones. This renders the attendance of a shepherd necessary, and requires likewise that they be driven to and from the fold. Further, the live-stock would by this means be rendered many hundreds per cent. more valuable to individuals and the community than it has hitherto been, or can possibly be, without inclosure; and, what is of the last, the greatest importance, it would tend to preserve such improved breeds from that destructive malady, the rot, which makes such terrible havock among our flocks. Add to this, that the markets would be more plentifully supplied with beef and mutton, and the price of these articles considerably reduced.

It does not, he says, appear necessary to state with precision (nor indeed is it capable of being so stated) what would be the increase in value of the commons of this county, on their being inclosed, and well and properly cultivated. It may, however,

with safety be stated at upwards of fifteen times their present value to the proprietors, and forty times their present value to the public. But increasing the rental of such land to fifteen, or perhaps twenty times its present amount, is by no means the greatest advantage that may be expected to result from an inclosure of commons. The general salubrity and healthiness of the country would necessarily be improved, while industry would be largely increased among the most useful classes of society; beggary and robbery much lessened, and the general stock of corn and cattle almost inconceivably augmented. And wherever inclosures are made with due attention to the interests of the poor (as they ought always to be), they will be found to ameliorate their condition, as much as they increase the property and the comforts of the rich.

It is further observed, that the commons of this kingdom being, with very few exceptions, without ridges, furrows, or drains, have not the means of discharging that superfluous water from the surface of them, which is well known to be of great detriment to vegetation in general. Many commons in low situations, and where the soil happens to be of a retentive quality, hold water like a sponge, which being always stagnant, as well as excessive in quantity, renders the soil of such commons much too wet for the pasturage of sheep; and is, no doubt, the cause of many of the disorders which that animal is subject to, particularly that fatal malady the rot. From the same causes, also, the neighbourhood of such commons must be particularly unfriendly to the health and longevity of man. Only let us reverse the scene, and for a moment suppose these commons to be inclosed, the necessary ditches and drains sunk, and the land brought into tillage, and we shall see all the superabundant moisture got rid of; and the water, being kept in constant motion, by trickling down the side of the ridges into the furrows, and from thence into the ditches and rivulets, will be found to fertilize the very soil which, in its present stagnant state, it serves to injure: while, by leaving the land dry, it will be rendered more healthy both for men and cattle. The effects of such a measure would soon show themselves in many districts of this island, which, at present, are very unpropitious to the health of man, in the much greater longevity of the inhabitants. It may also be farther noticed, that commons are entirely defective in the great article of labour; but no sooner does an inclosure take place, than the scene is agreeably changed from a dreary waste, to the more pleasing one, of the same spot appearing all animation, activity and bustle. Every man, capable of performing such operations, is furnished with plenty of employment, in sinking ditches and drains, in making banks and hedges, and in planting quicks and trees. Nor are the wheelwright, carpenter, smith, and other rural artificers, under the necessity of being idle spectators of the scene, since abundance of work will be found for them, in the erection of farm-houses, and the necessary appendages thereto; and in the forming and making roads, bridges, gates, stiles, implements of husbandry, &c. Even after a few years, when this kind of temporary exertion is over, by the whole being brought into a regular system of husbandry, it will still continue to provide both food and employment for a very increased population.

It is highly probable, that if the legislature should pass an act for the general inclosure of waste land, it would increase the quantity of rural labour so much as to advance its price considerably, and thereby have the good effect of drawing a vast number of hands out of the unwholesome confinement of manufactories; where, in addition to the life-shortening effects of such confinement, the morals of the people are exposed to certain contamination. With respect to the effect produced by inclosures on the population of the country, it may be observed, that the inclosing of 1000 acres in any one parish would probably require 100 different labourers, many of whom would undoubtedly be drawn from such of the adjoining parishes as had less work than workmen. Thus it must follow, that the neighbouring towns and villages would diminish, just as much as the parish in which the inclosure is going forward would increase, its numbers; yet the amount of the community will evidently be the same. But although the inclosing of waste land certainly does not immediately either increase or decrease population, as some writers seem to have supposed, yet that inclosures ultimately affect population (and that as to its increase), inasmuch as the district is thereby made more conducive to health, is sufficiently evident. Every thing that has a tendency to make a nation more healthy, and productive, must of necessity operate as a stimulus to population. The certainty of a man's being able, with ease and comfort, to provide for himself and family, by the increase of rural labour, is at once an inducement to marriage, and a consequent increase of population.

The inhabitants wholly supported by agriculture in England and Wales, appear, he says, to be nearly, or perhaps quite, six millions (while it supplies provisions for near two millions more), or one to every six acres and a half of cultivated soil. He estimates it in this way:

Cultivators of farms, six persons to every 100 acres, is	2,340,000
Ditto of gardens, hop-grounds, nurseries, &c.	300,000
Smiths, wheelwrights, bricklayers, masons, carpenters, painters, plumbers, glaziers, various manufacturers of furniture, woollen cloth, and making it up, linen, and making it up, leather, and making it into shoes, boots, &c. hose, harness, and saddlery: as many of each of this description of persons as are wholly employed by the cultivators of the soil, men, women, and children, about seven persons to each farm of 100 acres, is	2,800,000
The like of millers, bakers, maltsters, brewers, distillers, starch-makers,	

dealers in corn, and persons employed in the commerce of corn..........	500,000
The landlords of farms.................	40,000
Persons supported by taxes on the produce of land.....................	120,000
Total...........	6,100,000

Not but the extremes vary much, as there are some few grazing-farms, with only one soul to fifty, and arable farms that are peopled in the proportion of one person to three acres of land. In point of produce, the commons, in their present state, apparently, though he thinks not really, afford entire support to human beings in the proportion of one to an hundred acres. But by being inclosed, and brought into the present ordinary cultivation of the country, every six acres and a half might do the same. Should agriculture experience a rapid advance towards perfection, as there is reason to imagine it will, both from the exertions of the Board and of intelligent individuals, every three or four acres would, in a few years, be capable of supporting its inhabitant; and as, from its nature, it might certainly be carried on from one degree of perfection to another, it may even arrive at such a pitch of excellence, as that every acre of land shall support its man.

It is well observed by Dr. Anderson, that while land is in the condition of common, man is indeed debarred from ever being able to ameliorate the soil, and thus to augment its product to the state; but he is not prevented so effectually from deteriorating it. While in the state of a common, the surface of the ground may be broken by him in such a way, as not to recover for ages a sward equal to that which was originally upon it. It may be cast up and sunk into pits: it may be converted into wet and rotten marshes, by casual obstructions being thrown in the way of the water, which no one finds it his interest to remove: it may, in short, while a common, be abused in a thousand ways, by reason of the obstinacy, indolence, or caprice of individuals; but it never can be benefited by the industry of man: and not only may this be done, but these things actually are done, in innumerable instances; so that to a person who contemplates the loss that the nation must sustain by these deplorable abuses, nothing can afford a more melancholy train of reflections, than that which the frequent recurrence of those disgusting commons suggests to his mind, as he travels over the otherwise delightful country of England. When he stops to inquire more minutely into the effects of this kind of property upon the morals and domestic economy of the individuals who claim a right to these commons, he only finds additional causes for regret. He frequently discovers, that the quiet and industrious cultivator, having a right upon a common, is obliged to abandon that right, because of the harassments to which he is subjected from turbulent and assuming neighbours, who have obtained a small footing there, with a predetermined resolution, perhaps, to encroach much farther than their rights would authorise; because they know that, towards the restraining of these excesses, no obvious and easy means occur. Thus does the peaceable man often find it better to relinquish his right almost entirely, than be subjected to the perpetual contention that would occur in defending it. Such an inquirer frequently finds, that in consequence of this the small flocks of the poor cottager, who cannot afford to look after them continually himself, are so tormented, by being chased from place to place by those marauders, that, instead of a relief to the poor cottager, these flocks prove only a torment to him: his family becomes, in consequence of this, a burthen on the parish, which is obliged to support them; he finds, that among those who are bred up in these situations, there are many young men who delight more in active plunder than in sober industry; and who, tempted by the high prices that luxurious inhabitants of towns offer for game, become poachers, and form such powerful confederations of determined profligates for their mutual protection, that no one less determined than themselves will dare to interfere with them; which enables them to carry on their depredations with impunity. He observes, that the money these young men thus acquire, is usually squandered in drinking and riotous excesses: the young women are contaminated by their conversation, corrupted by their excesses, and debauched; the least evil attending which courses, is a great number of illegitimate children, and an extravagant poor rate. But who can estimate the detriment that a nation sustains, when the morals of the country inhabitants of it become corrupted? It is like tainting the springs of water with poison, which, instead of promoting health and vigour, as they naturally ought to have done, produce one univeral mass of infectious disease. It is common to read in the history of Britain, that the rot became, at times, so prevalent in England, as to carry off many millions of sheep at once; and these diseases were regarded, like the pestilence among the human species, as a terrible visitation of heaven for the sins of a guilty land. There is great reason to believe, that these frequent mortalities among the flocks were entirely occasioned by the numerous commons, which were in those times much more extensive than at present; for it is still known, that in neglected spots where water is allowed to stagnate and generate marshes, as is often the case with commons when the season proves wet, the sheep pastured upon them are, to this day, so much subjected to the rot, as to induce many persons, as has been observed, rather to give up their right, than to allow their flocks to enter upon these unhealthy pastures. Considered under every possible point of view, then, it appears, he says, to be undeniable, that the prevalence of commons is a great national grievance, which ought, if possible, to be removed; and that the Board of Agriculture cannot be more beneficially employed, than by granting all the aid that their wisdom can devise, for removing those bars that at present tend to prevent the equitable division of this kind of property.

From every one of the agricultural surveys yet

made, it is evident, that in every county in England and Wales there are extensive tracts of land of this description (for commons and wastes may be considered as nearly synonymous terms, although it be a truth, that many of these commons consist of land naturally as good as any in the kingdom). Of the extent of these lands, were it necessary, a tolerably accurate knowledge, he thinks, might be attained; but as to the amount of improvement, it is impossible for any person to form at present an idea of it, should the prosperity of this country be permitted to go forward, for a considerable length of time, in that accelerating ratio into which it would naturally fall, if the general tranquillity of the nation were preserved, and the obstructions which have hitherto repressed exertions in agriculture removed. It is enough here to say, that it would be an object of immense magnitude. He has had occasion to observe, that in some favourable situations, it is well known that land, in the course of a very few years, has been made a thousand times, at least, more productive than in its original state. Many commons are at present lying waste, in situations equally favourable as these: and many other situations may become equally favourable by an extension of those modes of facilitating intercourse, which are now in contemplation, and are only prevented from being carried into effect by barriers that judicious laws may easily remove. See *Waste Land.*

COMMONABLE-*Lands* are such lands as are generally in some measure arable, and which belong in property to individuals who are known, and the limits of whose property are ascertained; but which, in regard to their culture and mode of cropping, are subject to certain regulations, which custom, for time immemorial, has established, so as gradually to have acquired the force of law, to which rules every individual occupying such property must adhere, until these old customs shall be abrogated, either by the unanimous consent of all the individuals having a right to such commonable-lands, or by an express statute, obtained with their consent, for the purpose of annulling them. In some counties, Dr. Anderson says, it appears not much less than one-half of the whole arable lands are in this state; although it is evident, by the concurring testimony of the whole of the agricultural reports, that, taking all these lands at an average, they do not afford half the produce the same lands would do, if they were put under the ordinary management that appropriated farms are subjected to in their respective districts; and not perhaps one-tenth part of what they might easily be made to afford, within a very short period of time, should all other obstructions to improvement be removed. It would be tiresome, he says, to enumerate the whole facts that occur in the different agricultural surveys, tending to point out the pernicious tendency of this mode of tenure: but a few of them may be mentioned. In one place it is stated, that a few inclosures had been made, seemingly with the concurrence of the whole parties concerned; but when the hedges had advanced nearly to become a fence, one of the commonable tenants went deliberately and pulled them up by the roots, and eradicated them entirely. In another case, the parishioners having come to an agreement to sow clover, after that practice had been universally acquiesced in for the space of eighteen years, one of the farmers, occupying sixteen acres of land, bought a large flock of lean sheep in the mouth of May, and turned them on the clover-crops, which were nearly in bloom; and no one could hinder him. In another case, where custom had established the practice of having one corn-crop and one fallow, alternately, the occupiers of the district came to an agreement to have two crops and a fallow, alternately; but before the expiration of ten years, one of the farmers broke through the agreement, and turned his cattle upon the crops of beans, oats, and barley; in which plan he was followed by the rest of his neighbours; and the crops were, in consequence, totally destroyed on that part of the field, which, agreeable to the ancient custom, should have been that year in fallow. These notices, while they tend to illustrate the nature of this particular kind of tenure, at the same time, he says, clearly demonstrate its pernicious tendency to the public. No one who has considered the subject for a moment, but will readily admit, that it were much for the interest of Britain that no such practice existed in it; and that, of course, no time should be lost in endeavouring to eradicate it: for, were this effectually done, it must appear evident, from the facts stated, that the total produce of the kingdom would be greatly augmented. See *Waste Lands.*

COMMON-*Field Lands*, are a description of land of the same kind as the above, lying in extensive fields. There is a large portion of this sort of land in almost every county of the kingdom. It is observed by Mr. Middleton, that the common arable fields in the county of Middlesex are about 20,000 acres; and in that, as well as in most other counties, are divided into too many small properties to be advantageously cultivated. He says, he has known thirty landlords in a field of 200 acres; and the property of each so divided as to lie in ten or twenty places, containing from an acre or two downwards to fifteen perches: and, in a field of 300 acres, he has met with patches of arable land, containing eight perches each. In this instance, the average size of all the pieces in the field was under an acre. In all cases, he observes, they lie in long, narrow, winding, or worm-like slips. Land so distributed occasions great loss of time to the farmer, in removing his teams and labourers; and, what is of equal importance, he can neither cross-plough, nor harrow and clean such land in a workman-like manner. And another great inconveniency attending common-field land is, the farmer cannot crop with that which best suits his soil, but is confined to sow such grain as must be cut with his neighbour's. An Act to inclose common-field land would be advantageous to the farmer, and make the estates compact, and of more value to the owners. Neither can he sow any green or meliorating crops, vary the usual impoverishing succession, or even destroy the vermin. In

short, the cultivator of these lands finds his expenses double, and his crops only half of what they should be, if the land were laid together and well fenced.

By inclosing the common-fields, says he, which consist of a turnip and barley soil, both the landlord and the farmer are freed from the shackles of an exhausting and obsolete rotation of crops, and placed at liberty to stipulate for cultivating the soil in the most improved manner, keeping it clean, in better heart, raising such roots and green crops as are in the greatest demand at market, and only growing a crop of corn for the sake of renewing the course of green and root crops. In this manner, intelligent men, after inclosure, can double the produce of their land.

The invariable rotation of crops, in all the common-fields, is, first year a fallow, second year wheat, third year peas or oats, then begin again with a fallow. This, he says, is the destructive system of arable management, that mostly prevails in this kind of land, and by which some of the best land in the kingdom is condemned to be unemployed every third year; and the farmer who occupies it is compelled to pay three years' rent in taxes, for two years' use of it; and, of course, to maintain his family, servants, cattle, and implements of husbandry, every third year, without having any return from the land. It is, therefore, impossible that lands of this sort can ever be cultivated to the greatest advantage, while they remain in their present state. See *Inclosing* and *Waste Lands*.

COMMON-*Field Husbandry*, that sort of cultivation which is practised in common fields. It is observed, in the Agricultural Report of Wiltshire, that the introduction of the common-field husbandry seems to have been very slow and progressive; and that the dispersed situation, and smallness of the pieces, of the common-field lands now in cultivation, evidently show that the occupiers began with tilling a single acre, as one day's work for a plough, or, perhaps, only half an acre each; and that, as a want of corn increased, their cultivation was augmented, until they had cultivated all that was most proper for that purpose, still leaving those parts which were less fit for the plough, or more distant from home, in a constant state of commonage, but by mutual agreement keeping the cattle out of the cultivated parts till after harvest. This was, probably, the origin of common fields. It does not seem probable, that any improved methods of cultivation can be adopted on common-field lands, until the system of common-field husbandry is abolished.

COMMON *Meadows and Pastures*, such meadows and pastures as are held in a state of commonage. It is remarked by the author of the Agricultural Survey of Wiltshire, that, by the same kind of mutual agreement as is stated above, they shut up, and, in some cases, inclosed, such parts of their common pastures as were most proper to mow for hay, dividing them into certain specific quantities, either by land-marks or by lot, for mowing, and suffering the common herd of cattle to feed them again as soon as the hay was carried off, till it was time to lay them up for a new crop:—and that this was the origin of common meadows.

That, as is stated above, these mutual agreements, originally founded in necessity, became, when approved by the lords, and observed for a length of time by the tenants, what are called 'custom of manors,' constituting the very essence of the court baron, or manorial court; by which both lord and tenants were, and are still, bound; and of which, though the lord or his steward is the judge, the tenants are the jury; the custom of the manor equally binding both. See *Meadow and Pasture*.

COMPLICATION *of Diseases*, in *farriery*, is when an animal labours under many distempers at the same time, and more especially if they have any affinity to one another; as the dropsy, asthma, and jaundice, &c. which frequently take place together.

COMPOSITION *for Trees*, a substance or material, discovered, prepared, and applied by the late Mr. Forsyth, for the purpose of removing diseases, defects, and injuries, in fruit and forest-trees. It is directed to be composed in the following manner:—

"Take one bushel of fresh cow-dung, half a bushel of lime-rubbish of old buildings (that from the cielings of rooms is preferable), half a bushel of wood-ashes, and a sixteenth part of a bushel of pit or river-sand; the three last articles are to be sifted fine before they are mixed; then work them well with a spade, and afterwards with a wooden beater, until the stuff is very smooth, like fine plaster used for the cielings of rooms."

It is observed, that the trees should be prepared for its application, "by cutting away all the dead, decayed, and injured parts, down to the fresh, sound wood, leaving the surface of the wood very smooth, and rounding off the edges of the bark with a draw-knife, or other instrument, perfectly smooth, which must be particularly attended to; then to lay on the plaster about one-eighth of an inch thick, all over the part where the wood or bark has been so cut away, finishing off the edges as thin as possible; then take a quantity of dry powder of wood-ashes, mixed with a sixth part of the same quantity of the ashes of burnt bones; put into a tin box, with holes in the top, and shake the powder on the surface of the plaster, till the whole is covered over with it, letting it remain for half an hour, to absorb the moisture; then apply more powder, rubbing it on gently with the hand, and repeating the application of the powder till the whole plaster becomes a dry smooth surface.

"All trees cut down near the ground, should have the surface made quite smooth, rounding it off in a small degree, as before-mentioned; and the dry powder directed to be used afterwards, should have an equal quantity of alabaster mixed with it, in order the better to resist the dripping of trees and heavy rains."

Such portions of the composition as may be left for a future use, "should be kept in a tub or other

vessel, and urine of any kind poured on them, so as to cover the surface; otherwise the atmosphere will greatly hurt the efficacy of the application."

And "where lime-rubbish of old buildings cannot easily be got, take pounded chalk, or common lime, after having been slacked a month at least."

It is further remarked, that "as the growth of the tree will gradually affect the plaster, by raising up its edges next the bark, care should be taken, where that happens, to rub it over with the finger, when occasion may require (which is best done when moistened by rain), that the plaster may be kept whole, to prevent the air and wet from penetrating into the wound."

But, "as the best way of using the composition is found, by experience, to be in a liquid state," Mr. Forsyth adds, that it should "be reduced to the consistence of pretty thick paint, by mixing it with a sufficient quantity of urine and soap-suds, and laid on with a painter's brush. The powder of wood-ashes and burnt bones is to be applied as before directed, patting it down with the hand."

He recommends, that "when trees are become hollow, to scoop out all the rotten, loose, and dead parts of the trunk, to the solid wood, leaving the surface smooth; then to cover the hollow, and every part where the canker has been cut out, or branches lopped off, with the composition; and, as the edges grow, to take care not to let the new wood come in contact with the dead, part of which it may be sometimes necessary to leave; but to cut out the old dead wood as the new advances, keeping a hollow between them, to allow the new wood room to extend itself, and thereby fill up the cavity, which it will do in time, so as to make, as it were, a new tree."

If the cavity be large, to cut away as much at one operation as will be sufficient for three years. But in this to "be guided by the size of the wound, and other circumstances. When the new wood, advancing from both sides of the wound, has almost met, to cut off the bark from both the edges, that the solid wood may join, which, if properly managed, it will do, leaving only a slight seam in the bark. If the tree be very much decayed, not to cut away all the dead wood at once, which would weaken the tree too much, if a standard, and endanger its being blown down by the wind; it will consequently be necessary to leave part of the dead wood, at first, to strengthen the tree, and to cut it out by degrees as the new wood is formed. If there be any canker, or gum oozing, the infected parts must be pared off, or cut out with a proper instrument. When the stem is very much decayed and hollow, it will be necessary to open the ground, and examine the roots."

In the inventor's ingenious and useful treatise on the "Culture and Management of Fruit and Forest Trees," a number of interesting facts and observations are brought to the attention of the reader, which strongly show the vast utility and advantage of this composition, in the removal of different diseased states, in many different sorts of trees of the timber and other kinds. See *Timber Trees.*

COMPOST, that sort of manure which is formed by the union or mixture of one or more different ingredients, with dung, or other similar matter, so as to constitute an uniform mass.

It is remarked by Mr. Young, that "the farmer may have great advantage from composts; which, when they consist of proper materials, and are skilfully mixed, he may safely depend upon. Where a variety of materials can be had, they may, he says, be laid as follows: first, clay or strong earth, next soap-ashes, dung, loamy earth, lime, tanners' bark, green vegetables before they run to seed, earth, soap-ashes, dung, tanners' bark, earth, or as many of these as can be got: also, fat chalk, sea-weeds, sea-sand, and several others; which may be so mixed as not only to raise a general fermentation throughout the whole compost, but likewise to suit the nature of the land on which it is intended to be laid. The common way is to lay the several materials in layers, one over the other, till a large heap is raised; and it is advised by some authors, and the practice of many farmers is, to make these layers from six inches to a foot in thickness; but this he has found by experience is wrong. For the fermentation raised in the compost is not strong enough to penetrate these thick layers, especially those of clay, or strong earth; for after the rest have sufficienty fermented, and the compost is turned, these layers rise almost as whole as when first laid, and must be broken by hand, to mix them with the rest of the compost: whence arise two inconveniences; one, an extraordinary expense of labour; and the other, that twice or thrice turning is sometimes necessary to dissolve these large pieces; and, as a new fermentation is excited every time the compost is turned, the strength of the manure is greatly wasted before is is laid upon the land, where it is then incapable of raising any considerable fermentation, which is, he thinks, one of the principal uses of manure."

Composts are mostly made by mixing various substances with stable or yard-dung; and hence, in some counties, are called *mixens*. The most common materials used for this purpose are turf pared from waste places, virgin earth, peat earth, lime, scourings of brooks, ponds, and ditches, weeds, sea-sand, rubbish of buildings, coal-ashes, &c. That dung alone, properly managed and applied, is a most valuable manure, is beyond all doubt, but it is certainly not equally useful in all soils and situations. It is much better calculated for active than inactive soils. On limestone, chalk, &c. it meets with abundance of active materials; but upon clays, deep loams, &c. it operates best in conjunction with lime or some other stimulating substance. When dung is intended for a compost, no attempt should be made to add a large quantity of lime, earth, &c. till it is properly fermented, every addition of this checking the fermentation. The lime, earth, &c. should be added after the fermentation is finished, and the whole then carefully mixed and laid up together. In a few days a second fermentation will come on; and if the mixture has been properly turned over, and incorporated, it will be fit for use in a month or six

weeks. Some judgment and attention will be requisite, with regard to the quantity of lime and other active principles, employed: for, if the quantity be small, their action upon the rich substances in the dung will be partial and imperfect; and if too great, a considerable loss may be sustained by their over action. If the quantity of earth also be such as to press the dung too hard, the air will be excluded, and the second fermentation be impeded or prevented. It is certainly a right method to lay a good coat of earth as a foundation for the dunghill, into which the moisture of the dung may soak down; and it is no bad way to make a heap of such substances as can be readily obtained, apart from the dung, and to throw the moisture of the dunghill and the urine of cattle over it frequently.

The mixing of composts is performed in various ways. In some places, where there is a head or foot-ridge, too high to admit the water being readily discharged from the field, they plough it, then fill it full of lime, dung, or both, and, after frequent ploughings, spread it upon the field. After the lime, by these means, is sufficiently mixed, the earth may be gathered into a heap with the spade, and mixed with dung; or the whole operation may be performed with the spade, which is still better.

It has been suggested, that "the best way of making compost, is not in thick layers; but, after the ground is marked out for the compost, to lay the several materials, after being well broken, in heaps round the space marked out for the compost-heap; and to place a man between each two heaps, to throw the manure spreading upon that space. In this manner the compost-heap will soon be raised to the intended height, and the several sorts of manure being thus well mixed, the whole will soon begin to ferment, and will incorporate as fully in two months, as the same manures, placed in layers in the usual way, will in four or five. The owner, therefore, in making such compost, should not prepare them too long before they are laid upon the land; otherwise they will be much wasted, and their best parts evaporated" and destroyed. And "composts prepared in this manner, need not be turned, or at most not above once. If the fermentation is observed to abate too soon, holes should be made with a pole, from the top almost to the bottom of the heap, upon which throw urine, or the running of a dunghill, which will fill the holes, force through the whole substance of the compost, and soon complete the fermentation." It is added, that "such a compost, by duly proportioning the ingredients, may be made to suit any sort of land, and is excellent for meadow or pasture-grounds. A way to improve these, is to cut them five or six inches deep with the five-coultered cutting-plough, or scarificator, which cuts the surface in slips four or five inches asunder, but does not raise or turn them. This cutting of the roots of the grass, and the manure laid on at the same time, sinking into these incisions made by the coulters, causes an improvement in the quality of the herbage, and also makes such grass-grounds produce much more than they did before. But here it is to be noted, that cutting the ground first, and then laying on the manure, makes a greater improvement than manuring first and then cutting; and both are superior to manuring and not cutting; all which have been proved by experiments. The cutting-plough is used with success upon clay-grounds, loams, and gravels; but, in very strong grounds, the coulters are apt to be thrown out of their work by stones; and, therefore, it is not proper to use the cutting-plough where stones abound" to any great degree.

It is added, that "in such composts where it is intended to use a large proportion of earth, that lies at a considerable distance from the homestead, to save the double carriage of it to and from the compost-heap, the dung and other materials may be carried to a headland of the field to be manured, and be there mixed into a compost."

It is contended, that "the best situation for a compost, is upon level ground; or, if made upon a descent, a trench should be cut on the lower side to receive the running of the heap, which is some of the best part of it, and should, from time to time, be thrown up again, which will quicken the fermentation."

It is supposed, that "the richest composts may be made in the farm-yard, which should be made deepening all round, from the sides to the middle, in form of a hollow ditch or bason. When the yard is made in this form, little of the urine or liquid part of the manure can run off or be wasted. When the dung is carried from the stables, cow-houses, &c. into the farm-yard, it should not be thrown carelessly in heaps, each sort by itself, but carried in carts or wheel-barrows, and laid regularly, and spread all over the yard. Upon this should be spread a thin layer of earth, mud, the scourings of ditches and ponds, green vegetables before they run to seed, and other such materials as are most suitable to the nature of the land to be manured with them. The racks and cribs, out of which the cattle are foddered, should be frequently moved over the yard, that the offal, straw, and hay, may be equally dispersed, and trod in by the cattle. This method of spreading the dung, and other materials, being continued, the whole will be incorporated with the urine of the cattle, and make an extraordinary rich compost." It is supposed, that "the only inconveniency of this kind of compost, is its being filled with the seeds of weeds, from the earth mixed with it, the hay, straw, and dung of the cattle. It is, therefore, a manure best suited to grass-grounds, and to such arable lands as are to be hoed, as turnips, cabbages, carrots, potatoes, beans, &c. as these weeds will, in great measure, be destroyed by good hoeing," or a proper attention to the after-culture of the crops.

The earth or mud gathered from the bottom of ditches is excellent for composts. It is usually the lightest part of the soil, carried thither by water, and frequently contains a large portion of vegetable matter. To this may be added, the cleanings of roads, especially where they are laid with limestone. But one of the best materials for composts is peat-

earth. This fills up the pores of a sandy or gravelly soil, without diminishing its friability. Even when applied by itself to such soil, peat increases its fertility. But in a hard clay soil, it should be fermented with lime, or dung, or both, and frequently turned, to make it mix properly. Without this precaution, it dries, hardens, and cannot be afterwards properly mixed and incorporated with the soil.

In making composts, if only one sort of manure be used, it is only necessary to put the manure and earth in alternate layers, in a long ridge, and top it so that the rain may not wash through it. When both lime and dung are used, a layer of earth should be interposed between every two beds of lime and dung: for lime, if mixed with dung in the first stage of its putrefaction, corrodes and dissipates its effluvia. After the first fermentation of the dung is completed, the whole should be turned, to mix the ingredients; and this operation should be repeated until the mass be sufficiently pulverised; which is done by cutting the compost with a spade, in perpendicular slices. All the weeds should be collected from the neighbouring fields, before they run to seed, and mixed with the compost. The weeds also that grow upon it should be buried down in it. Such kinds of composts may be used for any crop, and, when sufficiently pulverised, are excellent for a top-dressing to pastures; the parts being gradually crumbled down, and beaten into the soil by the feet of cattle, or washed in by rains. Some are of opinion, that no advantage results from mixing dung with earth: a bottom of earth, however, must always be useful to detain the moisture that flows from the dung. Quicklime mixed with the dung is useful, by keeping the mucilage in a proper state, and preventing the putrefaction from proceeding to too great a length.

In a field properly suited, the following is another good method of making a compost, somewhat similar to that mentioned above:—Plough and harrow a head-land till the soil is well divided, and in fine tilth; then take a cart-load, or forty bushels, of lime, fresh from the kiln, and place it in little heaps, about a bushel in each, along the middle of the head-land, at four feet distance from each other. Cover the heaps with four or five times their quantity of pulverised earth, and pat it down close with the back of a shovel, so as to exclude both rain and air. In a few days the moisture of the earth will have dissolved the lime, and reduced it to a powder. If the heaps have any fissures in them, they should, from time to time, be filled up, by having more earth thrown upon them, and patted down close. When the lime is perfectly reduced to a powder, that and the earth must be chopped down with a spade, and intimately blended together. This is most conveniently done in form of a long bank or ridge, in the middle of which a large furrow or opening must be made, sufficient to receive five cart-loads, of forty bushels each, of good spit-dung; when the earth and lime should be thrown over the dung, so as to cover the whole. In this manner it should lie some months, or till the dung is in a state of dissolution. When arrived at this state, it should be turned over again, well mixed, and formed into a heap or clamp, to be kept for use. Earth, lime, and dung, thus managed, constitute an unctuous mass of great fertility. In Essex, they are particularly industrious in this practice; where, as the skirts of inclosures seldom produce any corn, on account of the shade and dripping of the hedges, and what it does produce is of little value, because the birds prey upon it, they generally sink these borders at least a foot deep, and mix them into compost, for the benefit of the rest of the land, which is more exposed to the sun, and less liable to be preyed upon by birds. Next to these borders of inclosures or banks of roads, the scouring of old ditches, the mud of ponds, and sediments of stagnant waters, are valuable, especially on grass-land; and a small mixture of lime is well bestowed upon them. Any maiden earth, with one-seventh part of lime, and another seventh of rotten dung, makes good manure for most kinds of pasture-land.

The making compost dunghills is a general practice in Norfolk. The principal source of them is the shovelings of ditches, which is found there to be singularly fertile. It is not the sediment of water from the inclosures, but consists entirely of dead weeds, leaves of the hedge, and the mouldering of the bank and sides of the ditch. The most barren substratum, exposed a few years in the face of a ditch-bank, is frequently changed into a rich black mould. Perhaps the sea-air, acting upon a loose porous soil, may assist in producing this change. Other sources of manure are, useless turf, the backs of ditch-banks, the borders of fences in general, the sides of lanes, the nooks of yards, &c. which, in many places, are suffered to remain the nursery of weeds. These are turned up into ridges, to rot the roots of the grass and weeds, and to receive the melioration of the air; which done, it is carted in due season to the dung-heap, to be well incorporated with that substance.

A good and effectual mode of raising a large quantity of compost-manure, is to bed the farm-yard about two feet deep with earth, and on this to cleanse the stables, cow-houses, hog-sties, &c. and to move the cribs in which loose cattle are fed with straw, about it. This bed of earth will retain the urine; so that, when the whole is mixed together, it will all be nearly of equal goodness, and admirably adapted to gravelly and loose soils in general, through which the essence of dung alone would be washed in one season; and a top-dressing of soot, pigeon's dung, &c. would last but one crop, and very rotten pure dung would be little better. Having the drains from the stables, cow-sheds, and other offices, made so as to discharge themselves into places where these different sorts of earthy materials are deposited, might be a cheap and expeditious method of procuring good compost-manure.

On binding pebbly loams, having so strong an adhesion as to be what farmers justly call unkindly land, having the tenacity of clay without any of its excellencies, small quantities of dressings, however

rich, are of little benefit; a pound of the essence of dung might be so fast locked up in a large clod, as to be rendered totally useless for a whole season: a rich top-dressing of soot, &c. is often quite lost on such land. Nothing does so well with it as composts, not kept long, carried on in very large quantities. Perhaps twenty loads on an acre may do little good, when forty loads may be effectual: for there must be quantity enough to keep the clods and loose earth from uniting, or else the manuring is of little service. Small quantities, also, raise no fermentation; and it is obvious, of what consequence a strong fermentation completed in the soil must be to such sort of land.

Another good method of raising compost dunghills, is by making them into clamps. Make a layer of hedge-earth from a grubbed border, two feet deep, and about twelve feet square, in the beginning of November; the quantity of earth will be about twenty-six loads, of sixteen bushels each; on this clean all the yards and sheds. The yard, not being bedded with earth, should be well littered, to soak up the urine, and to be made into dung by the hogs and loose cattle; this may be cleaned once a fortnight, and the sheds once a week; and piled regularly on the foundation of earth, until the heap is about seven feet high; and when one clamp is thus filled up, another foundation of earth may be laid adjoining to it. In order to enrich the compost, the flowings of the heap should be prevented from running off, and thrown up occasionally on it. By thus piling the compost in clamps, it will be in very good order, for arable land, early in the spring; which will not be the case if it be left to be trodden flat over the whole yard, and every particle washed by the rain. Fermentation goes on much quicker in this method, and it would be better still if the heap were made under a roof, to keep off all water but what is thrown up. Another advantage of this method is, that any part of the compost may be used, by taking a division of the hill that has been the longest finished, and is, consequently, in the most suitable state for application. See *Dung*.

All sorts of animal substances, mixed with earth, litter, or any vegetable material, make a rich compost. Saw-dust, mixed in layers with the blood and offal of a slaughter-house, and incorporated till the whole becomes a moist fœtid mass, is a rich compost. Two loads of it, with three loads of earth, will be sufficient for an acre of wheat or spring-corn. Being a kind of top-dressing, it should be put on at the time of sowing, and harrowed in with the grain. This kind of manure is best adapted to lands of an open texture. Tough clays require lime, and plenty of dung, to break the cohesion of their parts. As this compost takes up little room, it is very convenient for the use of such farmers as are obliged to bring manures from a distance. It is also extremely rich, and will, probably, continue longer in the land than yard or stable-dung. All animal substances being of the same nature, the refuse of whale-fat, after the oil is boiled out, will make a rich compost with fresh dung, which will reduce the blubber speedily into a putrid state, or with earth and dung. Having marked out the length and breadth of your intended dunghill, make a layer of earth, such as moor-earth, or that of ant-hills, about a foot in thickness; over this put a layer of yard or stable-dung, of the same thickness; then a layer of blubber; and over that another layer of dung. Repeat the operations till the heap be raised about six feet, then give it a thick covering of earth, and coat the heap with sods. In about a month, turn the whole in the usual manner; and when turned, coat with earth, as before, to confine the putrid steam. In a month or two, the heap will be considerably fallen, when it should have a second turning. This operation must be repeated at proper intervals, till the whole becomes an uniform putrid mass. In general, this compost should not be used till it is a year old. The heap must be guarded from dogs, swine, &c. This compost may with great advantage be applied to all purposes where good rotten dung is required. It is excellent for cabbages, and for meadow-ground. One hogshead of whale refuse will make eight loads of dung; and must be of great importance to such farmers as lie at a distance from manure, but within reach of those places where train-oil is prepared. The practice of throwing this kind of offal into the sea was highly wrong and inconsiderate.

It is obvious, that the refuse of all sorts of fish, and fish itself when in shoals too great for consumption in the way of food, may advantageously be made into a compost, in the way above-described. These are local advantages; and are mentioned principally with a view to put farmers upon searching diligently for such substances as may be within their reach, that are capable of assisting the sheep-fold and common dunghill, upon which, in many places, they rely wholly, however inadequate to their wants —abundance of good manure, properly managed, being the life and soul of husbandry. Where there is a deficiency of materials for making good composts, proper for the soil, in many cases, a mixture of different soils may answer the purpose. Thus, where clay predominates, the addition of sand, where it is happily within reach, is often sufficient to ensure fertility; and where sand prevails, the addition of clay or chalk will answer the same purpose. Gravel enriches peat-moss; and that, in return, improves gravel. The farmer should, therefore, search every where, above ground and below, for such substances as may improve his several soils, by being properly mixed with them.

In the application of all composts, particular care should be taken to suit them to the nature and quality of the soil. For instance, if the field on which the compost is to be laid be clay, or strong loam, the earthy part of the compost should contain sand, gravel, chalk, or other light substances, such as are best calculated for separating the particles of such strong and adhesive soils. On the contrary, if the field be light and sandy, the compost should be formed chiefly of clay, and other earths of a tenacious nature, such as tend to give density to such

light friable lands; by which means, more than by any other, their fertility may be effectually promoted. See *Manure.*

CONCRETION, in *farriery*, is a term used to signify the growing together of any parts which are separate in the natural state.

CONCUSSION, in *farriery*, a term made use of to signify the shock of any part, by which its functions are impaired. Concussions of the brain, by blows or falls, are common to brute animals; and the circumstances attending them are, no doubt, somewhat analogous to such accidents in the human subject. It is often difficult, when an accident from external violence happens to the head of an animal, to ascertain what kind it is, and where it is seated. In such circumstances, the symptoms, how the misfortune happened, with any other points that may throw light upon the case, are to be considered.

It is observed, that the signs of a concussion do not always appear immediately after the injury is received. The symptoms attending it are generally in proportion to the degree of violence which the brain itself has sustained, and which, indeed, is discoverable only by the symptoms. If it be very great, all sense and power of motion are immediately abolished, and death follows soon: but, between this degree and that slight confusion (or stunning as it is called) which attends most violences done to the head, there are many stages. Sometimes a concussion produces the same kind of oppressive symptoms as an extravasation, and the animal is either almost or totally bereft of sense; at other times, no such symptoms attend. A violent blow on the head, not beating the head to the ground, nor against any hard body, most frequently causes a fracture or fissure, with but small concussion: when a blow is given with such violence as to knock a horse down, and his head hits the ground, if the skull is not thereby broken, a concussion will be the consequence. If the head strikes against a hard immoveable body, in consequence of a fall from a considerable height, a concussion, with an extravasation, usually follows, and generally death is the consequence. A concussion of the brain seldom is attended, if ever, with extravasation, unless when re-action follows the blow. A concussion, with a fracture, is less dangerous than one with a fissure; because, in the first case, the extravasation is less. And it is said, that to distinguish betwixt a concussion and extravasation on the brain, in cattle, is extremely difficult, if not impossible. Where violence has been exercised on the heads of animals, or in similar effects from accident, if death do not supervene, copious bleeding, and the means directed generally in apoplexy, should be had recourse to. See *Apoplexy.*

CONDIMENTS, in *husbandry*, are such substances as, in respect to animal bodies, are supposed to possess a stimulating power, without contributing much in the way of nutrition;—as spices, salt, bitters, opium, vinous spirit, &c. These, on being taken into the stomach of an animal, increase its activity and digestive power, and of course enable it to take in a larger proportion of food than usual, in a given space of time, by which it becomes more expeditiously fat. On this subject it is remarked by Dr. James Anderson, that too little attention has been paid to these materials in feeding animals. Hitherto, says he, the greatest part of mankind seem to forget that mere animals have the sense of tasting in as great perfection as man; and are disposed to indulge their appetite for sensual gratifications, without any restraint, wherever circumstances put it in their power. The uses that may be made by man, for his own emolument, of this natural propensity of animals, are very obvious when adverted to. Yet he knows no case in which the general attention of men seems to have been strongly turned to the point, unless it be in respect to the fattening of calves: but he has met with few persons who have had an extensive practice in this department, who are not sensible that the profit is in proportion to the quantity of milk that the creatures can be induced voluntarily to take in a given time. This solitary fact is known by thousands, he says, who never once think of extending it to any other case of animal existence. But there are not wanting a few persons, who, in consequence of accurate observation, have discovered the vast importance of studying with care the taste of the creatures they feed, that they may not only furnish them with the kinds of food they like best, but also to vary these from time to time, and to give them exactly in the quantities, and in the way that they find will induce the creatures to eat the most; having the full experience that the profit to be drawn from feeding beasts is always proportioned to the increased quantity of food they can get each individual coaxed to consume in a given time. In this branch of rural economics, he has met with no person who has made greater progress than a plain practical farmer at Hope, in the neighbourhood of Manchester, who spares no trouble or expense in procuring such kinds of food and condiments as he finds best calculated to induce his cows to consume, in a given time, the greatest quantity of food possible. The consequence, he observes, is, that this man makes much money, where his neighbours, who are not in the secret, and more niggard in their outlay than he is, sustain a loss. Among other condiments, this man has discovered that pure water stands pretty high in the scale; on which account his beasts are never suffered, far less obliged, to taste a drop of water that has ever been sullied by any animal setting a foot into it. With this view, they are always served with running water, which is, for their convenience, received into a long wooden trough, through which it passes while they are drinking. Such poor beasts as are compelled, through necessity, to drink out of those muddy stagnant pools in which other cattle have waded for days together to cool themselves in hot weather, and which are fully impregnated with their dung and urine, feel the inconvenience of this nauseating draught; and the farmer of course suffers an abatement of his profit to an astonishing degree. Astonishing to him, it may, he says, be justly called: for though he feels the effect, he seems to be ignorant of the cause, and therefore suffers it to exist, without

an attempt to remove it—as every attentive person must have observed in many thousand cases.

There can, however, be little reason to doubt, that animals which can be induced voluntarily to take an extra quantity of food, in a given time, will be quickly fattened by that practice. On this principle, therefore, many substances may be used to advantage in the feeding and fattening of different kinds of animals. An excessive use of them should, however, be avoided, as they have ultimately a tendency to produce relaxation and weakness.

CONDITION, in *horsemanship*, a term supposed to imply a horse's being in such a state of perfection, and in strength and power so much above the purpose he is destined to, that he displays it in his figure and appearance: this, according to Taplin, signifies "fine in coat, firm in flesh, high in spirits, and fresh upon his legs." If the subject be a young horse, and stranger to hard work, he says, this may well be the case; but, on the contrary, where a horse has been much worked, either on the turf, field, or road, a great degree of good fortune must have attended him, if he have not suffered from some one of the many dangers to which he has been exposed. In the getting a horse into condition, especially a hunter, after being taken up, if he is free from lameness, and there is no blemish, infirmity, or any other obstacle, to forbid such proceedings, he should first be put upon a very moderate proportion of hay and corn, increasing it gradually, according to the size and constitution. At the expiration of three or four days, when the hard food may naturally be supposed to have dislodged the grass, and supplied its place, a proportion of blood should be taken away, according to the size, state, strength, and temperament of the horse, with due attention to the flesh he may have gained.

The following mild alterative powders for *promoting condition* in horses, is advised by Mr. Riding:

Take of antimony, in fine powder, one pound; nitre, twelve ounces: Mix them together for use.

An ounce being given every night and morning in the horse's corn, previously sprinkled with water, to make it adhere; or it may be made into a ball with a little tar.

CONE-WHEAT, a species of wheat, some of the ears of which have awns, and others none. See *Wheat.*

CONFORMATION, *External, of the Horse*, the shape or mould of the animal. As the powers and qualities of this animal are known to depend considerably on this conformation, it is a point which has long deeply interested those who have given their attention to the improvement of the breed.

An able writer, Mr. R. Lawrence, has remarked, that "as deformity is constituted by a want of harmony in the component parts, it will not be difficult to perceive, that a long head and a short neck, or a short head and a long neck, cannot be esteemed handsome.

"The neck should proceed in a line from the top of the head, forming a regular progressive curve to the withers. The trachea, or wind-pipe, should be large in diameter, and somewhat detached from the fleshy part of the neck. The size of its diameter has a considerable influence in respiration. Large wind-pipes are peculiar to blood-horses, whence, probably, they are better winded than all others. The chief beauty of the forehand depends on the union of the neck with the shoulders. The neck should issue high, and nearly in a line with the withers, and its lower part should enter the chest high, and above the point of the shoulders: the opposite conformation to this produces what is termed an ewe-neck, which can never be esteemed handsome.

"The shoulders constitute the centre of motion in the fore part of the body; and the extent and elasticity of that motion will depend chiefly on the position of the shoulder-blades. The connection of the shoulder-blades with the body is established by muscles only, independently of any joint whatever. It is by the alternate contraction and extension of these different muscles that motion is produced, and it is by their united elasticity that the shock is broken when in action.

"This would not have been the case, had the shoulder terminated in a fixed joint. The truth of this remark may be ascertained by riding alternately on the withers and the croupe, and comparing the difference of their respective motions.

"As it is the office of the hinder quarters to propel the body forwards, it is necessary that they should be closely united with the body by means of joints. But, on the other hand, as the fore quarters are chiefly employed in sustaining the equilibrium of the machine, the concussion which must have been produced if they had been united to the body by joints, would have been considerably greater than what is produced by their being attached by muscles only. In describing the action of the shoulder, it will be necessary to consider its position when in a state of immobility.

"The scapula, or blade-bone, is placed obliquely from the chest to the withers, and the center of its action is fixed in the middle of it. In its action, it describes as large a portion of a circle as the extension of its muscles will admit. If this portion of a circle, for instance, be ten degrees, and the two different scapulæ possess the same degree of extension, the one situated obliquely, the other perpendicularly, it must necessarily follow, that, acting on their respective centers, the one which is oblique must elevate its lower extremity higher than that which is perpendicular, and consequently will increase the projection of every part of the fore-limb. Hence it appears, that an oblique position of the shoulder is most favourable for progression. The shoulder may want liberty, either by being too fleshy or too lean. In the first instance, it is overloaded; and, in the last, it possesses not muscle sufficient to enable it to perform its functions with strength and celerity.

"The muscles of the chest contribute greatly to the motion of the lower part of the shoulder. Hence a strong and moderately full chest is to be preferred

to one that is narrow and meagre. It will probably be urged, that horses are sometimes possessed of great speed, whose forehands in no wise agree with this description; but such horses are generally endowed with particular powers in their hinder quarters. The fore quarters are merely passive, and extend themselves to receive the weight of the body; and, if they are sufficiently strong for that purpose, the animal may certainly move with considerable velocity: but thence it is not to be inferred, that a greater velocity might not be produced, if both the fore and hinder quarters were alike perfect in their conformation.

"The fore legs will next come under consideration, on the good structure of which the safety and ease of the pace of the animal will chiefly depend. A horse, whose legs are twisted, or improperly placed too far under his body, may possess great speed; but that his action must be imperfect, the following reasons will, he says, sufficiently demonstrate: If the foot turns either inwards or outwards, it cannot alight flat on the ground, in which case the position can never be firm and steady; because the pressure will be partial on either the inward or outward quarter of the foot. If the leg is not perfectly straight from the shoulder to the foot, its action cannot be true, nor the center of gravity so readily found, as by one that is even and uniform in all its parts. If the elbow incline inwards close to the ribs, the leg must be thrown sideways when in action, which will remove the foot too far from the center of gravity, and produce a lateral rolling motion, very unpleasant to the rider. Again, if the legs incline too much under the body, they will be overloaded, and the freedom of their action will be reduced in proportion as they are oppressed. The fore legs, to be perfect, should, he says, in a front view, be widest at the chest, gradually approaching each other downwards towards the foot, and descending in a perpendicular direction to the ground. The upper part of the fore leg, next the shoulder, should be broad and muscular. The power of elevating the knee, and throwing the leg forwards, depends much on the size of the muscles in this part. The knee, in a front view, should be broad, flat, and square; the lower part of the limb, between the knee and the fetlock, should be short, flat, and wide in a lateral view. The tendons should be distinct, firm, and detached from the bone. The fetlock should correspond in proportion with the rest of the leg, neither too upright nor too sloping. If it is too long, its ability of sustaining the weight of the body will be diminished; and, if it is too short, it will be liable to knuckle over. Short pasterns are generally attended with contracted feet, the weight of the body not being thrown so much on the heel as is the case with long pasterns. The general proportion of the limb is constituted by two equal divisions, viz. from the elbow to the knee, and from the knee to the ground. The length of the fore leg should correspond with that of the hind leg; that is to say, the elbow should describe a horizontal line with the stifle, otherwise the harmony of motion is lost; as is the case in a carriage, where the fore wheels are of a smaller diameter than the hinder wheels, on which account they are obliged to perform three revolutions to two of the latter."

Many of these observations and directions may be usefully attended to in the purchasing and breeding of horses.

CONGESTION, in *farriery*, signifies a collection of matter, as in abscesses, tumors, &c.

CONIFEROUS *Plants and Trees*, such plants and trees as bear cones, as the fir, pine, cedar, &c.

CONSOUND, a provincial term applied to bugle. See *Bugle*.

CONSUMPTION, in *farriery*, a disease incident to horses, consisting in a waste of muscular flesh, attended with a slow fever.

The consumption frequently arises from colds that have never been thoroughly cured, but have left some chronic affection of the lungs, or some other of the principal viscera, especially of the parts contained within the chest. This results sometimes from violent inward strains, in working a horse beyond his strength, or when he has a cold upon him; travelling a horse beyond his strength; riding long journeys without allowing sufficient food, or proper times of baiting and rest upon the road; riding in the night in damp and wet weather; and from other such-like errors: and sometimes consumptions proceed from weakness or other faults in the constitution; sometimes from pleurisies, surfeits, or long-continued disease of any kind.

When consumption proceeds from a defect in the horse's lungs, or other principal viscera, the eyes look dull; the ears and feet are mostly hot; he coughs sharply by fits; sneezes much, and frequently groans with it; his flanks have a quick motion, he gleets often at the nose, and sometimes throws out a yellowish curdled matter; and he has little appetite to hay, but will eat corn, after which he generally grows hot. In the cure, one of the principal things in the beginning is bleeding in small quantities, as to the amount of a pint, or a pint and a half, which should be repeated as often as the breathing is more than ordinarily oppressed. Pectorals may be given at the same time to palliate urgent symptoms; but as dissection has shown that both the glands of the lungs and mesentery are frequently swelled, and often indurated, the whole stress should be laid on mercurial purges, and the following alteratives, given immediately:

> Take of native cinnabar, or cinnabar of antimony in fine powder, one pound; of gum-guaiacum, and nitre, each of the same quantity: give the horse an ounce of this powder twice a day, wetting his feeds.

In these cases the spring grass is often serviceable, but the salt-marshes are to be preferred, and even to be more depended on than medicines. But horses frequently relapse after appearances of amendment: when a yellowish gleet, or curdled matter, runs from their noses, and they grow emaciated, are much addicted to sweat, heave much with reduplicated motion, and have short rattling coughs, there can be

little hope of their recovery, or of any future service from them.

After proper bleeding, Gibson recommends the following balls, which, if the horse be young, will be useful:

Take of conserve of red roses, one ounce; Lucatellus's balsam, half an ounce; spermaceti in powder, sal prunella, of each two drachms; balsam of sulphur anisated, sufficient to make it into a ball; to be rolled in liquorice-powder or wheat-flour.

Of these balls one may be given every morning for a week; and if they be found to do service, be continued during pleasure, till the horse recovers his usual vigour, and begins to gather strength. A quart of the decoction of bran, or of linseed, may also be administered after each ball, made warm, dissolving in it an ounce of gum-arabic, or gum-tragacanth; but if the horse scours, or runs at his nose, so as to induce weakness, the following infusion may be used:

Take of ground-ivy, horehound, of each a handful; red rose-leaves, half a handful; linseed, juice of liquorice, of each half an ounce; gum-tragacanth, an ounce:

Infuse these in a quart of boiling water, letting the infusion stand covered till cold.

It should be made milk-warm, and given every morning after the ball, with the usual precautions; that is, fasting two hours before, and two hours after, allowing not above a quartern of scalded bran; for, when scalded bran is often given, and in great quantities, he says, it hurts the horse, by relaxing too much, and is greatly injurious in all habitual weaknesses. His oats should be the hardest and sweetest that can be got, and his feeds also small, that he may not be cloyed. His hay should also be the finest, and the dust well shaken out of it, and given in small portions, that he may digest it easily. But nothing contributes more to the cure of a consumption, than air and exercise, though any excess in the latter is dangerous; and, therefore, a weak consumptive horse should only be led, or ridden by a person of a light weight; and, if short-breathed, should only be walked. He should be continued in the air as much as possible, upon some dry common, or other place where the air is good, which is the most likely way to bring him to his stomach, and, consequently, to his strength; and, if he mends by this management, there may be some hopes of his recovery, provided he be young; but if he be full-aged, or old, or if he continues still weak and faint, runs a viscid gleet from his nose, has a fulness of the glands under his jaws, coughs much and wastes in his flesh, and grows weak, with a stinking breath, it will not be worth while to bestow any labour or expense to save him.

CONTAGION, in *farriery*, a term used to signify the communicating or trasferring a disease from one body to another, by certain steams or effluvia, transmitted from the body of a diseased animal. In this way, some diseases are propagated by immediate contact or touch; as the madness of a dog, &c. and also the glanders in the horse. But others through the medium of the air to a great distance, as in some pestilential distempers incident to horned cattle, &c.

CONTRACTION *of the Hoof*, in *farriery*, is a distorted state of the horny substance of the hoof in cattle, producing all the mischiefs of unnatural and irregular pressure on the soft parts contained in it, and consequently a degree of lameness which can only be removed by removing the cause. Contraction of the hoof rarely happens, however, except to those animals whose hoofs, for the convenience of labour, are shod with iron. Hence the importance of shoeing animals, particularly horses, on sound principles; an object to which great attention has lately been paid. See *Hoof* and *Foot*.

CONTUSION, in *farriery*, an affection produced by a blow, or other similar cause. In these cases, either the small blood-vessels of the contused part are broken, and the blood they contained spread about in the adjoining parts; or else, without such an effusion of it, these vessels have lost their tone or active force, and, no longer contributing to the circulation, their contents stagnate. In either of these, if nature, with or without the assistance of art, does not remove the impediment, an inflammation comes on, followed by an imperfect unkindly suppuration, with putrefaction or gangrene. Beside which, there are peculiar symptoms from the injury done to a nerve, a blood-vessel, or a bone, in such instances. Where they are not severe, they are mostly removed by discutient applications.

CONVENTIONARY *Rents*, a term applied to the reserved rents of life-leases.

CONVOLVULUS, the name of a troublesome weed. See *Bind-Weed*.

CONVULSIONS, in *farriery*, are those involuntary and alternate contractions of the fibres or muscles of an animal which arise through the medium of the nerves. When convulsions attack only particular parts, they are often attended with some kind of paralysis at the same time, by which means the affected parts are alternately convulsed and relaxed. A permanent convulsion, or unnatural contraction of particular muscles, is called a *spasm*, or *cramp*. These partial convulsions may attack almost any part of the body of an animal, and are not unfrequently symptomatic in fevers, worms, &c. The involuntary startings of the tendons in acute diseases, are all of them convulsive disorders. Convulsions, even when most generally extended, differ from epilepsy in not being attended with any abolition of sense, and in not being followed by the same torpid state. Convulsions, not only of particular parts, but also over the whole body, often take place from causes not very evident. Sometimes, in young animals, they seem to depend merely on the irritability of the nervous system, which is strongly affected by slight causes. They, however, often take their rise from wounds, irritations of the stomach and intestines, by worms, poisons, violent cathartics, &c. They are always to be dreaded; but less in young animals than in such as are of more advanced age,

A recovery is most frequently effected by the removal of the existing cause of the disease. See *Epilepsy*.

COOM, the soot that gathers over the mouth of an oven. Also a composition of tar and grease, with which the axletrees and boxes of wheel-carriages are daubed or smeared over, in order to lessen friction.

COOMB, a measure of grain. See *Comb*.

Coomb, a provincial term applied to a narrow meadowy bottom, which lies between hanging woods.

COOP, a provincial term applied to a tumbrel or cart, enclosed with boards, to carry dung, sand, grains, &c. It is sometimes written *Coup*. See *Cart*.

Coop, a pen, or inclosed place, where lambs, poultry, &c. are shut up to be fed or fattened.

COPPICE, a low kind of wood, which is cut at stated times, for poles, fuel, &c.

In choosing spots for making new coppices, care should be taken to select such soils and situations as are proper for the growth of those kinds of wood intended to be planted; to drain them well if wet, and particularly to fence them well from cattle; and if they are covered with bushes and briers, to let those remain for shelter for the young wood; and if there happen to be a moderate quantity of young oak and ash-trees on the spot, to let them stand by all means, always keeping in mind how necessary shelter is for the growth of wood of all kinds and sorts. But in newly-planted woods, where all the plants are of the same age, there is not the same reason for letting them stand before they are stooled off for underwood, as for young trees planted to fill up old woods. Those which are intended for underwood may, in such newly-planted woods, be cut off when planted, or at any age from eight to fourteen years, without injury: indeed, young woods should not stand too long previous to the first cutting. It is observed, in the seventh volume of the Letters and Papers of the Bath Society, that the kinds of wood to be planted in coppices, either in making new ones, or filling up old ones, should be regulated, partly by the demands of the country, but chiefly by the peculiar aptitude of the soil and situation, to produce particular sorts. Let nature be the guide, says the writer, in planting, and you will seldom do wrong. Particular soils and particular situations will always favour particular kinds of trees; we need not look for the reason, but only for the fact. The chalk hills of Hampshire are peculiarly proper for beech; the flinty loams and clays of the same county for oak and ash; the mossy steep sides of the Wiltshire downs for hazel, and the sands of the same county for ash; the rugged and almost naked rocks of Mendip, in Somersetshire, produce the lime-tree and the walnut in the greatest luxuriance; and on the highest parts of the same Mendip-hills, where no other tree can stand the sea-breeze, sycamore flourishes as well as in the most fertile valley. Taking the general demand of counties, and the peculiarities of different soils, into consideration, it is asserted, that there is no kind of wood so generally proper for planting in coppices, as ash. The value of ash-poles being at least one-third more, and frequently as much again, per hundred weight, as that of other poles, as being applicable, at all sizes, to some useful purpose or other, the timber being always in request, and saleable at any age or size, at almost the price of oak; and the wood itself being as quick a grower as any, and quicker than most; and, above all, there being but few soils, from the blackest and wettest bogs, to the highest and most exposed mountains, where it will not grow, are reasons why ash is one of the most profitable woods to plant in such coppices as are favourable to its growth. In soils and situations where ash does not grow kindly, let such other sorts of wood be planted as appear to thrive best in similar soils and situations, in the same county. Spanish chesnut, though not so general a grower as ash, is a most excellent wood, either for timber or underwood, and wants only to be more known to be higher in estimation. It partakes much of the properties of oak, but excels it in two points, viz. that it grows faster, and that the sap part of the timber is firmer and less corruptible. To fill up woods that are grown thin by age or neglect, the proper time is one year, or at the utmost two years, after the underwood is cut. The young plants should be eight or ten feet high, and an inch and an half diameter at the ground, and should be planted without cutting off. If the soil be dry, no other preparation is necessary than barely digging the holes for the plants. If wet, deep drains should be made to take off the superabundant water. The earth dug from these drains should be thrown out on the lower side of them, and upon this new earth the plants should be planted. If land of this latter description be black and peaty, ash is peculiarly proper for it; and will, if planted on the earth thrown from the drains, make a most surprising progress. If it be a stiff yellow clay, it is generally more favourable to the growth of oak than of ash. In such soils, oak for timber, with a mixture of willow, birch, alder, and Spanish chesnut, for underwood, will, perhaps, be the most proper. All these kinds should stand one round of the underwood; and if still weak, should stand two, before those are cut off which are intended for underwood. Birch-plants are, indeed, an exception to this rule; they should always be cut off the first round of the underwood; for, if they are large when cut off, the stocks frequently decay and die. In all mixtures of kinds of wood for coppices, those sorts should be used which are not unfriendly to each other, and which will come round fit to be cut together at the same periods; and such kinds should be allowed to stand for timber, and that at such distances, as to injure the underwood as little as possible. The plants for filling up old decayed woods, should be the strongest and best of their kinds. Those which are weak at first, will be drawn up by the surrounding underwood, and become, from their increased height, still weaker. At the next cutting of the underwood, they will be blown down; or, if cut off, the shoots will be too weak to grow up with the other underwood.

Oak, ash, and Spanish chesnut, should be kept in a nursery for this purpose; alder and birch-plants grow plentifully, spontaneously in some countries, and may be taken up for use; if none such are to be obtained, they may be raised from seed, sown on a moderate hot-bed in the open air. Alder is sometimes propagated by taking up old roots, and dividing them into several parts; and hazel may be propagated the same way. Willow is generally planted in cuttings; but a much better way, where there are any old willow stocks, is to plash down the shoots to fill up the vacant places round such old stocks. The wild cherry, which will grow on almost any soil, and is easily propagated, makes an exceeding good underwood, though, as yet, it is but seldom used for that purpose.

It is remarked by Mr. Donaldson, that the coppice woods, when the shoots are young, whether of oak, ash, elm, or birch, or a mixture of these with other sorts, are very little attended to in any part of the island—fencing being the only particular which marks the difference between a good and a bad manager. But, he says, where the wood can be sold for different useful purposes, at various stages of its growth, as is the case in many parts, an essential improvement, in the management of coppices, might be introduced with great propriety. In all such situations, it would be profitable to the owners, were the shoots thinned two or three times between each general cutting. The weedings or thinnings would do much more than defray the expense; while, by admitting a more free circulation of air, and by cutting off the supernumeraries, the principal shoots would advance more rapidly, and become, by that means, fit for sale, perhaps, two or three years sooner than they do by being allowed to remain in a neglected state. This is a circumstance that particularly merits the attention of those who are favourably situated, in regard to market, for the various productions of coppices, as saving two or three years in the regular cuttings would materially enhance the value of the land so occupied.

He further observes, that several other improvements in the management of coppices, might certainly be effected, were the owners to bestow due attention. It frequently happens, that, from mismanagement in cutting, many of the stools become useless, while scraggy thorns, brambles, &c. are allowed to spring up and occupy the place of more valuable plants. Were the owners of coppices, in general, to permit their labourers, or other industrious poor people in the neighbourhood, to dig up the decayed stools and useless brushwood, for fuel, under condition that they plant healthy vigorous stools in their place, the coppices, by this management, would necessarily become more valuable. Much damage, also, frequently happens from allowing the underwood to remain scattered over the surface of the wood, for a considerable time after it is cut. Every person must be sensible, that if the cuttings are allowed to remain in this situation till after the young shoots begin to spring, it is scarcely possible to remove them without breaking or otherwise injuring these tender sprigs. In all auctions of coppices, it ought, therefore, to be an article of sale, that the whole should be carried off the premises in a limited time; and the forester, or wood-officer, should receive injunctions to see this condition of the sale strictly fulfilled.

Much greater care is requisite, he says, in cutting coppices properly, than the owners, in many cases, are disposed to bestow. It cannot be supposed, when fifty or a hundred purchasers, with their assistants, are allowed to use their axes with no other view than to cut the wood which they have purchased, without regard to the success of what may be called the next or following crops, that any regard will be bestowed as to the proper manner of cutting. It is certainly of much importance, not only for the future vigour, but also for the durability of the stools, that the stems or shoots should be cut in that manner which experience has proved most effectual for answering both purposes. The shoots ought to be cut as low as possible without injuring the stools. When that practice is adopted, the stools remain nearly even with the ground, and consequently in a much better state of preservation than when by cutting the stems at the height of six, eight, or ten inches; as, by this method of cutting being frequently repeated, the stools get, in process of time, as he has frequently seen, to the height of several feet above the surface soil. Another common error, and which wood-cutters of the above description may be supposed very guilty of, is to leave the butt-ends of the stems jagged and uneven, and part of the bark torn off, or loosened all the way down to the stool, than which nothing can be more injurious. The butt-end of the stems ought rather to be brought to a point in the middle, and the bark remain quite close and firm, otherwise dews and rain drop into the hollows, and either rot or otherwise prove ruinous to the future health and vigour of the stools. In short, to render a coppice both valuable and lasting, a regular system of management ought to be adopted. For the reasons mentioned above, they ought to be thinned two or three times between every general cutting. The useless brushwood ought to be rooted out, and other more useful plants substituted; where too much water abounds, drains ought to be opened; the fences at all times kept in a substantial state of repair; and on no consideration whatever should the purchasers of coppices be allowed to cut down the woods. Men employed by the owners, and who are properly bred to the business, ought only to be employed; who, by bestowing proper pains in dressing and pruning the butts and stools as they go along, would thereby ensure the springing of numerous and vigorous shoots the following season.

The periods of cutting underwood must be regulated, it is observed in the work first mentioned, by the luxuriance of its growth, and by the demand of the country, and the uses to which the wood is to be applied when cut; but, in general, the common rule of trade will hold good here, viz. "that small gains and quick returns make the dealer rich,

but long credit ruins." In the article of underwood, not only the interest of money, but the loss of the succeeding growth, tells against the value of standing wood after it is fit to cut, and makes it doubly the advantage of the owner to cut his underwood as early as it is saleable. As soon, therefore, as any kind of wood is fit for the uses of the country, it should then be cut; unless it can be made appear, that it will pay compound interest for standing longer, or, in other words, will pay not only the simple interest of the first value, but also the loss of so many years growth of the wood, as so far advanced towards another crop. Wood merely for fuel can scarcely be cut too young. Hazel is usually fit for hurdles and dead hedges, from nine to twelve years old; ash for sheep-cribs, at the same age, and ash and other woods, for hop-poles, from eleven to fourteen years old: while ash for carpenters, and other large uses; alder, birch, and willow, for rafters, turners' uses, pattens, clogs, coal-pit uses, &c. must stand from sixteen to twenty years old, before the poles are large enough for their respective purposes. It, therefore, behoves every owner of woods of the latter description, unless he is public-spirited enough to give up his own profit to the good of the public, to consider well, before he suffers his wood to stand to the age of sixteen, eighteen, or twenty years, whether the value of such wood, when cut younger, and sold for other purposes, added to the interest thereof, up to the usual period of cutting, and the gain by the growth between those two periods, will not more than equal the value the wood will be of, if suffered to stand so long; and if so, whether he ought not to cut his wood at shorter periods. He will have this additional satisfaction, that, by more frequent cuttings, his woods will be the less liable to decay, by the strong shoots smothering the weak ones, as is before explained, and will have an opportunity of letting up more saplings for timber than he could otherwise do. There are many opinions respecting the most proper time of the year for cutting underwood; but there is one rule which, on the seller's part, is without exception, viz. that the older the wood is, the later in the spring it should be cut. When old wood is cut early in the winter, and a hard winter follows, the damage done to the stocks is very great;—young flourishing wood will bear cutting at any time. But on the part of the buyer, it is allowed, that all woods are more durable when cut in the most stagnant state of the sap; and, in all uses where bending is required, such as hurdles, hoops, and even dead hedges, the wood cannot be cut too early in the winter, being, if cut when the sap is rising, brittle, and unfit for those purposes. Oak underwood will, at the present price of bark, pay well for standing till the sap is up for barking it, and it seldom happens that the stocks are injured by cutting it so late in the year.

The best way of disposing of underwood, to answer the purposes of the seller, is, in the opinion of this writer, to cut it at the seller's expense before it is sold; to lay it out in ranges or drifts, according to the custom of the country; to value it in that state, and sell it in such sized lots as the number of buyers may warrant; always keeping up a sufficient number to make a competition, and particularly to oblige the buyers to clear the whole out of the wood by the 24th day of June, and never to suffer them to bring their horses into the woods, after any new shoots are shot out, without muzzling them, or at least tying up their heads.

But Mr. Donaldson thinks, that the more approved method of disposing of coppice, or other under-sized wood, is that which is practised in Northamptonshire. When the season for cutting arrives, which is during the winter months, or before the sap begins to ascend, that operation is performed by people employed by, and who work under the direction of, the owner of the woods or his agent. The part of the wood intended to be sold is parcelled out into regular-sized lots, to suit the convenience of the intended purchasers. The whole of the underwood growing upon each lot is indiscriminately cut, and laid in one direction. As soon as the operation of cutting is completed, and the wood parcelled out in a proper manner, a valuation is put on each lot or parcel, according to its quality, and the whole is then sold by public auction, to such persons as incline to become purchasers, who, over and above the price of the underwood, repay the expense of cutting. This is, however, by no means the general mode in which woods of this description are cut. It is a very common, but a very bad practice, to sell the coppice under the condition that the purchasers are to be at the expense of cutting it down. This is often performed in such a careless manner, that the stools are so greatly injured, that they either rot and die, or a few weak stinted shoots only spring up. The price of coppice or underwood varies so exceedingly, that it is almost impossible to form any idea of the value of the acre. Perhaps, 8*l.* or 9*l.* may be not far from the average price of coppices, not remarkably situated in regard to market, and when they are cut every twelve or fourteen years. But the value of coppices depends on many circumstances; as, the sorts of wood, the uses to which they are applied, the price of bark, &c. In some parts of Kent, where hop-poles are in great request, an acre of coppice will yield sometimes 30*l.* or 40*l.* at a cutting. Whereas, in Scotland, where the coppices are for the most part oak, and where the wood is chiefly used for fuel, or converted into charcoal, the value of the coppice consists almost entirely in the quantity and quality of the bark, the wood being little more than sufficient to defray the expense of cutting and peeling.

After observing that the age and size of cutting this sort of wood must constantly be regulated by the demand of the district, whether it be for cord-wood, hop-poles, hoops, stakes, faggot-wood, or other ware; Mr. Marshall observes, that the mode of disposal is to be determined upon by the succeeding crop. Where the land is to be wholly appropriated to coppice-woods, it is, he thinks, in general, the most eligible to dispose of the crop as it stands, by auction or written proposal. But where

seedling plants are to be set out for timber-stands, or the young shoots from the stubs to be trained up, in the grove manner, it is requisite that the proprietor should employ his own men in reaping the crop, and making it up into such wares as are the most saleable, and, at the same time, the most profitable. In cutting this sort of wood, he thinks, the main circumstances to be attended to, are to perform the work in season, to take off the stems clean and smooth, with upward strokes of the axe, that the stubs may shoot out again with greater certainty, and to take them off as low as can be conveniently done, in order that the shoots may be few, and as strong as possible.

Coppice-*Wood*, that sort of small wood which is produced in coppices, and which is useful for many small purposes of the farmer, &c.

COPPY, a provincial word used to signify coppice. Hence, to coppy, signifies to cut for underwood. See *Coppice*.

COPY-HOLD, that sort of tenure of land which is under copy of roll of a manor, &c.

According to the author of the Landed Property of England, when lands "are held of a superior, as part of a royalty, honor, or manor, and are liable to fines, or other out-goings, on account of deaths, transfers, or other circumstances, they are *copyhold*; and are subject to the ancient customs of the royalty, honor, or manor of which they are respectively a part."

Copy-hold *Court*, that sort of court which is held by the lord of a manor. See *Manor-Court*.

Copy-hold *Lands*, such lands as are held under the copy of the rolls made by the lords or stewards of the manorial courts, and according to the customs of the particular manors.

Copy-hold *Tenure of Land*, that which is held under copy of roll of a manor. See *Copyhold*.

CORCULUM, the small heart or essence of a bud, and the principle of life, of the future vegetable. It consists of two parts, the plumula and rostelum; and is the embryo of the future plant, being attached by two trunks of vessels to the labes of the seeds at their union; the first of these ascends and becomes the trunk, the latter descends and forms the rudiment of the root.

CORD, a term signifying the string by which the testicles of male animals are suspended, and which pass up it through the abdomenal ring into the belly.

Cord, a small kind of rope. See *Rope*.

Cord-*Wood*, small sorts of broken-up wood, formerly sold by the cord. It also signifies top-wood, roots, &c. cut and set up in cords.

Cord *of Wood*, a certain quantity of wood properly stacked up for fuel; so denominated from its being formerly measured with a cord. A statute cord of wood should be eight feet long, four feet high, and four feet broad.

CORDAGE, an useful article of the rope kind, much employed by the farmer. The common cordage, according to a writer in the Agricultural Magazine, is fabricated in the following manner:—"The common rope is formed of filaments or threads, which again are combined into what are called strands, and a number of these strands united compose the rope. The filaments or threads, which are technically called yarns, when combined in the strand, are twisted one over the other, in such a way that the exterior parts have the greatest degree of tension. So, likewise, when the strands are connected to form the rope, they are twisted in the same way, so that the exterior parts have the greatest degree of tension. It is therefore evident, that a rope thus compounded, has the internal part contracted into folds or plications, that if it be composed of a thousand yarns, gradually as they recede from the center, this contraction decreases, and the tension increases, until you come to the outside or superfices of the rope, where the tension is the greatest of all. From this short explanation, it will in a moment occur to every inteligent mechanic, that whenever any weight operates powerfully on the rope, it will first be borne by the exterior part, then the outer strands will consequently break; that the weight will be next supported by the strands adjacent to the outer strands, which the weight will again break, until it press the interior strand, and breaking that last of all, it is restrained no longer. The mischief of a rope of this construction is obvious. If all the strands had been capable of operating together, the rope would probably have been effectual for the purpose to which it was applied; but as only one portion of its power was called into action at the same time, it must gradually be fractured in the way he has described, until it is reduced to the last filaments."

On this fabrication of the rope, Captain Huddart, of Sunderland, has invented an improvement, for which he obtained a patent in 1793, by which, it is said, the above detriment is avoided, and the rope made almost undestructable, either by wear or accident. "He has contrived a perforated plate, and a cylindrical tube, by which all his yarns are disposed in concentric circles, so as to make his ropes a complete and uniform mass of strength. For this purpose, all the strands of which his cords are composed are of different lengths. The exterior are the longest, and they gradually diminish in length to the center yarn, which is the shortest of all. It will be apparent, that this variation in the length is necessary for the purpose, because the outward ones going round the inner ones, must either be the longer, or else stretched so as to lose that substance necessary to make them secure. To show the superiority of this rope, the result of an experiment made by John Rennie, an ingenious engineer, well known for his superintendance over many public works in the kingdom, may be given. He has made a series of trials on the subject, one of which may be sufficient. A rope was formed of the same hemp, one end of which was manufactured agreeably to the patent, the other according the common method. The former sustained a weight of 17 tons, 5 cwt. 1 qr.; the other, equal in dimensions, supported only a weight of 8 tons, 13 cwt. 1 qr. 4lb. The former gave way with a crash, the other snapped gradually, beginning with

the outside yarns, and terminating with the center one. This single experiment, faithfully given, precludes the necessity of all comment on the comparative power. It may, however, be worth while to notice a convenience in the employment of this species of rope, which will surprise those who have not become acquainted with its structure. It will wear like a mass of steel. When the outside is injured by friction, the interior part being wholly independent of the external strands or layers, is perfectly round, and in this state it continues until it be worn to the last thread." It is added, that "in the navy of England, this cordage has been extensively employed; but it has not yet been applied, except in a very limited degree, to the purposes of trade or agriculture; and yet the numerous accidents which daily occur, and the multiplicity of impediments which arise in laborious business, should sufficiently recommend it to public notice. The writer further suggests, if this species of rope be substituted for the ponderous chains which are used in farming, the expense of harness will be reduced to half its present charge, and the animals be permitted to perform their labour without any other incumbrance than what necessarily arises from the pressure with which they have to encounter in the business of the field. In hay and straw harvest, it is well known, the calamitous accidents which result from the fracture of the cords, in drawing the produce from the field, when there is too often carelessness in the loaders, and almost always great inequalities in the surface, so as to make the utmost means of security expedient: but it is useless to recapitulate those numerous instances where attention in this particular will be beneficial, since none but the most inexperienced can be doubtful of this advantage."

This improvement in the manufacture of ropes, should be attended to by the farmer, as, if found to answer in the above manner, it must be valuable for various purposes.

CORDIALS, in *farriery*, a term applied to such remedies as have the power of stimulating the stomach, and quickening the circulation of the blood. All the different aromatic substances, as well as volatile and ardent spirits, are of this kind.

The indiscriminate use of these remedies in farriery, is much reprobated by Mr. Clark. He says, "when horses fall sick, it matters not with some what may be their complaint: it is too common to give them such articles as many people esteem cordial or comfortable things to themselves; these are ardent spirits, a little diluted, or wine, ale, &c. either alone, or heated and mixed with different kinds of spices. Wine or ale may indeed, he says, be given, in very small quantity, to a horse that is in health, when tired or fatigued on a journey, or in consequence of very hard labour; but they are by no means proper to be given in any quantity to a horse that is sick, more especially ardent spirits, as neither the stomach nor the head of a horse, even in health, can bear much of these liquors at any time. On the contrary, he soon turns giddy, and loses the use of his hind quarters during a fit of intoxication; and, when given to a horse that is sick, they may be expected to add fuel to the disease, except the malady be such as to demand stimulant remedies; but such distinctions are seldom attended to."

Cordial-*Ball*, in *farriery*, a kind of ball composed of different sorts of seeds and spices. See *Ball*.

CORE, in *farriery*, a disorder incident to sheep, occasioned by the presence of small flat worms situated in the liver. The greatest chance of removing this complaint is by changing the sheep into a more airy and dry pasture.

CORIANDER, the name of a plant but little cultivated at present. The seed should be sown in autumn, on rich land; and when the plants are come up, they should be hoed out to about four inches distance every way, clearing them from weeds. By the above management, they will grow strong, and produce a greater quantity of good seed.

The advantages of cultivating this sort of crop are thus stated in the fourth volume of the Bath Letters and Papers. "Sowed ten perch with coriander-seed, the soil a good sandy loam.

EXPENSES.	£.	s.	d.
Three ploughings	0	1	6
Sowing and harrowing	0	0	1
Four pounds of seed, at 3*d*.	0	1	0
Harvesting	0	0	3
Ripling	0	1	0
Rent	0	2	0
	£.0	5	10

PRODUCE.	£.	s.	d.
87 pounds of coriander-seed, at 3*d*.	1	1	9
Deduct expenses	0	5	10
Profit	£ 0	15	11

or 15*l*. 18*s*. 4*d*. per acre."

The author observes, that he since made several larger experiments on this article, but that none has proved so good a crop as the preceding; yet all of them such as to afford a good profit. There is a ready sale for it with the distillers, druggists, and confectioners. The former purchase very large quantities—the price varies from 16*s*. to 42*s*.

CORN, the general name of such kinds of grain as grow in ears, as wheat, barley, &c. If corn be lodged, it should be cut before it is quite ripe; and if blighted, it cannot be cut too soon. But where neither of these accidents happen, both wheat and barley should be suffered to stand till they are fully ripe. The grain may also grow plumper by being left awhile in the field after cutting, to take the dew; but the straw will be injured by it; but it must not by any means be laid up damp in the mow, lest it heat, and become what is called mow-burnt.

The means of preserving corn in the straw, and after it is threshed, will be described under their proper heads. See *Stacking and Preserving of Grain*, and *Granary*.

Some sorts of soil are better adapted to the production of corn than others; in general those which are dry, and of a mellow friable quality, are the most suitable for the purpose; but considerable latitude in those respects may be allowed, according to the nature of the grain to be cultivated.

Lent-Corn, such kind of corn as is usually put into the ground about that season.

Spring-Corn, all such corn as is sown in the spring.

White-Corn, a term applied to all sorts of grain.

Corn-*Farm*, a farm suited to the growth of, or which principally produces, corn. See *Farm*.

Corn-*Land*, that sort of land which is capable of producing corn.

Corn-*Laws*, those laws and regulations that relate to grain. These laws have lately undergone much alteration and improvement, in consequence of the dearness of corn; but they are still defective in a high degree.

It is observed by the author of Modern Agriculture, that it was not till after the Revolution that a bounty on corn was first adopted, as a measure calculated to promote the general interest and improvement of the country. That this regulation had the desired effect, is, he says, an unquestionable fact, that may be at any time ascertained by an examination of the public records. From the period when the bounty was first granted till the year 1757, when the former corn-laws were first altered and partly suspended, the quantity of grain exported gradually increased every year, and at last became a very considerable article of British commerce. It appears from the Custom-house books, that in fifty years, from 1698 till 1748, there were eight millions four hundred and thirty-six thousand nine hundred and sixty-two quarters and a half of wheat exported; besides four times that quantity of malt, barley, rye, and oatmeal. The rapid improvement that took place in the agriculture of the country, and in the extension of tillage lands, in consequence of the then existing corn-laws, evinces, he thinks, the correctness of the principle on which they were founded, however deficient they might have been in some particulars; for, during the first thirty-five years of the period above-mentioned, the quantity of wheat exported was only

exported was only -	qrs. 4,083,247	0 bush.
Whereas, during the last fifteen years, there were exported - -	4,353,715	4
	qrs. 8,436,962	4 bush.

So that the exports of the last fifteen years exceeded those of the preceding thirty-five no less than two hundred and seventy thousand four hundred and sixty-eight quarters and four bushels. But from the year 1757, when several material alterations were made in the corn-laws, till the year 1773, when the principle on which the original corn-laws were established was in a great measure abandoned, the export of grain gradually became less; and from the last mentioned period till 1793, that is, for twenty years, the balance was turned against this country to the extent of four hundred and thirty thousand one hundred and fifty-seven quarters per annum. This immense difference in the statements may, he says, be partly accounted for from the increase of population, without attending to the extension of tillage lands in the same proportion, but is, he conceives, chiefly owing to the corn-laws, enacted since that period, having been framed more particularly for the purpose of promoting the manufacturing interest; whereas those originally established went on the broad principle of promoting the general prosperity of the country, by a deviation from which, he contends, a large annual importation in ordinary years is rendered indispensably necessary for the very existence of the inhabitants. The corn-laws of Great Britain, as they at present stand, Dr. Anderson says, are extremely inadequate for the purposes intended by them. The principle of them, if any consistent principle can be fairly recognised, is erroneous. As they at present stand, they neither are, nor have been, nor can be, executed. They are calculated to give rise to jobs, chicanery, and frauds innumerable. They unnecessarily interrupt the internal commerce of grain, so as to distress the people, and depress the agriculture of the nation. Under the pretext of attempting to lower the price of corn, they really enhance it beyond what it ought to have been, and give occasion for the interference of government in innumerable cases, where that interference can only prove hurtful to the people at large.

It is owing, he further asserts, to an ill-judged partiality to the manufacturing interest beyond that of those concerned in the cultivation of the soil, that the balance of the corn-trade has been allowed to turn so much against this country; and unless a very material alteration take place in the arrangement of the corn-laws, that balance will, in his opinion, every year become more considerable, and the most serious consequences may be expected to ensue. The opening of foreign markets for grain, he maintains, induced the farmers, who, as well as the manufacturers, are always attentive to their own interest, like them to exert every endeavour to supply the demand. They encreased the extent of tillage-lands, as the ports of Europe opened to their view; so that, while plenty reigned in the land, foreign nations were maintained on the superabundance of our crops. Mark the contrast, says he: The various corn-laws that have been enacted in later times having all in a greater or less degree one object only in view, that of furnishing the manufacturers with bread at a price that gave them an undue advantage over the farmers; and it being necessary to shut the ports of Europe against the farmers, in order to effect this object, they very prudently turned their attention to the bringing forward such articles to market as, if there happens to be a superabundance, they know the manufacturers will be permitted, after receiving their share of the profit, to export, as woollen cloth, leather, salted provisions, &c. For this change of system, under the existing circumstances, although having a direct tendency to increase the evil, he asks,

are the farmers of Great Britain to be blamed? Certainly not. If the legislature shut out the farmers from the sale of their grain at foreign markets, except under rules and regulations, and on such terms as amount almost to a prohibition, who can censure them? If, seeing the cultivation of grain a losing concern, from their being under orders as to the mode of sale, as well as restricted in a great measure as to price, they embark in another undertaking, viz. the rearing and fattening live-stock, the surplus of which, through the medium of the more favoured classes of British subjects, the merchants and manufacturers, they know can be exported in one shape or other to any part of the globe, are they not right?

After observing that if the corn-trade were carried on without regulations or restrictions of any kind, as has been suggested by the author of the Causes of the Wealth of Nations, the most baneful consequences would ensue: But, says he, if in place of that constant shuffling and changing, that endless cutting and carving on the corn-laws of this country, which has taken place since the year 1757, one thoroughly digested and deliberately framed act of parliament, on the original principle of making British corn an article of foreign commerce, were to be passed, those concerned in husbandry would find it more for their interest to devote their attention to the cultivation of grain than under the existing circumstances they do; and of course such an act of parliament would have the effect of rendering corn not only abundant, but, when compared with other articles, moderate in price. If ever it shall become the ruling principle to guard alike the interests of the farmer, the merchant, and the manufacturer, plenty will again visit the land. We shall, besides being enabled to throw off our dependence on foreign nations for an annual supply of bread-corn, have it in our power, by our exports, to draw back from these nations the immense sums, which, owing to the impolicy of the corn-laws, we have been obliged to expend. But till regulations respecting the sale and export of grain, as liberal as those which regard the manufacturing and commercial concerns of the country, are enacted into statutes, and the farmer be left as unfettered as the merchant or manufacturer, neither of these events can be expected to happen. Much useful information may be found on this subject in Dirom and Hewlet's writings on the Corn-Laws, as well as in several papers in the second and third volumes of the Farmer's Magazine, published at Edinburgh. It is much too extensive a subject to be fully introduced in a work of this nature.

Corn-*Stubble*, that sort of stubble which is left after reaping or cutting any sort of grain-crop. See *Stubble*.

Corn-*Stubble Rake*, an useful sort of large horse-rake, which is made use of in some districts with much advantage. See *Rake*.

CORN-CROWFOOT, the name of a weed very common among corn. It has an upright stalk; the leaves are of a pale green, and cut into long, narrow, acute segments. The flowers are much smaller and paler than those of the crowfoot which is found in pasture-grounds, and the seed-vessels are very remarkable, being covered all over with prickles.

CORN-FLAG, the name of a very troublesome weed, which multiplies exceedingly by the root. It has a round, compressed, tuberous root, which is of a yellowish colour, and covered with a brown furrowed skin, like that of the vernal crocus. From this root arises two flat sword-shaped leaves, which embrace each other at their base; and between these the flower-stalk comes out, which sometimes grows nearly two feet high, having one or two narrow leaves, embracing it like a sheath. This stalk is terminated by five or six purple-coloured flowers, standing above each other at some distance, and ranged on one side of the stalk; each of these has a sheath, which covers the flower-bud before it expands, but splits open lengthways when the flowers blow, and afterwards shrivels up to a dry skin, which remains about the seed-vessel till the seeds are ripe, which is generally in the beginning of August. The flowers mostly come out about May or June. It frequently happens some of these flowers are white, and others flesh-coloured. This weed is extremely difficult to eradicate, as every part of the root is capable of producing new plants. The best manner of extirpating it is, probably, that mentioned under the article colts-foot. See *Colts-foot* and *Weeds*.

CORN-MARYGOLD, the name of a plant of the weed kind, of which there are two species, one common in corn-fields, and the other in moist pastures. The leaves of the first sort embrace the stalks, the upper being jagged, and the lower indented like a saw. The second is, by some botanists, called the greater wild daisy, with a leafy stalk. It rises with stalks near two feet high, furnished with oblong indented leaves, which embrace the stalks with their base. Each of these stalks is terminated by one white flower, shaped like that of the daisy, but considerably larger. It flowers in June. It has a perennial woody root, which, striking deep, requires a considerable quantity of food, and of course must be a great enemy to all corn-crops. Considerable pains is necessary in order to effectually extirpate this weed, as it is highly probable, that, besides multiplying by its roots, its seed will grow, if ploughed in, as that of the garden marygold does when dug under. Deep and repeated hoeings will therefore be necessary before it runs to seed. See *Weeds*.

CORN-PARSLEY, the name of a low branching plant commonly met with among corn. The branches grow thick together, and are knotted and crooked, and the flowers are close together after the manner of parsley, and of a white colour inclining a little to yellow. The seeds are large in proportion to the plant; and are set about with little crooked bristles, which make them adhere to the stockings in great plenty, when the seeds are ripe, which is generally the case about harvest-time. See *Weeds*.

CORN-WORM, an insect of the caterpillar kind, said to be very destructive to corn. See *Butterfly*.

CORNER-TEETH, in horses, are the four teeth placed between the middle teeth and the tushes, two above, and two below, on each side the jaw, and which appear when they are coming five years old. At first they are but just equal with the gums, being filled with flesh in the middle. These differ from the middle teeth, in their being more fleshy on the inside; they grow leisurely, and differ also from the other fore-teeth in the kind of resemblance they bear to a shell, whence they are called the shell-teeth, because they environ the flesh in the middle half-way round; and, as they grow, the flesh within disappears, and leaves a distinct hollowness and openness on the inside. The corner-teeth on the upper gums cast out before those on the under, so that the upper corner-teeth are seen before those below. See *Age of the Horse.*

CORNET, in *farriery*, a name sometimes given to the instrument used in venæsection, called a fleam.

CORNS, in *farriery*, a frequent affection in the feet of horses, and which, according to Mr. Denny, in his Treatise on the Diseases of Horses, is a disease arising from inflammation of the sensible sole near the heels, and mostly at the inner quarter.

" It is discovered, he says, by lameness, particularly on the animal's first going from the stable. The foot feels hotter than usual, and, on taking off the shoe, considerable pain is perceived on pressing the part. The horney sole appears of a red or brown colour, from an effusion of extravasated blood. If the inflammation be not early attended to, it proceeds to the formation of matter, which either insinuates itself between the lamina of the hoof and foot, escaping at the coronet, or, from its corrosive quality, destroys the horney sole, and is discharged at the bottom of the foot." He adds, that " bad shoeing is generally the cause of the disease." And, that " horses that have naturally flat feet and thin soles, are commonly subject to corns."

In order to " effecting a cure, the diseased part should, he says, be removed with the drawing-knife, taking care not to injure the hoof. The wound may be dressed with tincture of myrrh and lint; and the foot be, during three or four days, covered with a common bran poultice, changed two or three times daily. Afterwards a bar-shoe is to be applied, to rest firmly on the frog, and to prevent any pressure being received opposite to the seat of the disease. The foot may be stopped daily with the following application :"

Take of common turpentine, hog's-lard, tar, of each a quarter of a pound. Mix them well together.

And " when the common shoe is again applied, it will be necessary to make the sole, from the quarters to the heel, as concave as the strength and thickness of it will admit; taking care that the shoe rest firmly on the bar and crust at the extremity of the heel." Cases of this sort require to be carefully attended to, otherwise the horses are apt to remain lame a long time.

CORONARY *Bone*, in *farriery*, the little pastern, in the horse.

CORONET, in *farriery*, the lowest part of a horse's pastern, which runs round the coffin, and is distinguished by the hair which joins and covers the upper part of the hoof. The coronet should be no more raised than the hoof, nor make, as it were, a ridge or height round it. It is sometimes written *Cronet.*

COSH, a provincial word signifying the same with pod. It also signifies the husks or chaff of wheat and oats. See *Pod.*

COSSART, a term that signifies a lamb left by the death of its dam before it is capable of providing for itself; or a lamb taken from an ewe that brings two, three, or four at a yeaning, and consequently is incapable of bringing them all up. In any of these cases, if there be not another ewe at liberty to suckle them, they must be brought up by the hand, or perish. By an ewe being at liberty is meant, one that has, by some accident, lost her lamb, and has milk enough to suckle one yeaned by another. The term is also sometimes applied to a colt, calf, &c. It is sometimes written *Cosset-Lamb.*

COSTIVENESS, in *farriery*, a complaint to which horses are often subject, occasioned sometimes by violent or hard exercise, especially in hot weather; and sometimes by standing long at hard meat, without grass, or other cleansing diet, and with very little exercise.

The cure of this complaint is generally easy, only requiring an open diet for a little while. Where any thing more is wanting, lenitive mild purges are the most likely to succeed; such as Glauber's salts with lenitive electuary, four ounces of each, dissolved in warm ale or water, and repeated every other day. This, with scalded bran given every day, will mostly soon remove the complaint.

But there is another kind of costiveness in these animals more difficult to be removed, that which is natural, or grown into a habit. Some good horses are liable to this disorder; and, when it is of long continuance, they are apt to grow lean and emaciated, feel hot and dry, their hair staring, and looking badly.

This state of the complaint is not so easily removed, nor is it frequently necessary to bring such horses into a contrary state; as, when such a habit can be kept in a proper medium, the horse may continue in strength and vigour, without any inconvenience; and horses thus situated are, for the most part, able to endure great fatigue and labour. However, it will be proper to give such horses, at all convenient times, an opening diet, lest an habitual costiveness should be produced, causing heat, dryness, little scabby eruptions over the skin, and a rough coat, effects which can only be removed by a continual use of mild laxatives, joined to a loose opening diet. Purging in the common way with Barbadoes or other plantation aloes seldom has any great effect longer than the purge is working; as, when that is over, the same habit of costiveness generally returns as strong as ever. Scalded bran, or the common opening diet, of themselves, seldom make any great alteration in these horses. Where common purges have failed, the following will sometimes succeed:

Take of succotrine aloes, six drams; of spermaceti, half an ounce; of fœnugreek seeds in powder, two ounces: make the whole into two balls, with a sufficient quantity of honey, or common treacle, and give them in a morning fasting.

During this course, let the horse have scalded barley, linseed or scalded bran, and the liquor of the barley, milk warm, for his drink. This often works very gently, where stronger purges have little other effect upon costive horses than of griping and making them sick. It ought to be repeated once in four days, and may be continued till he has taken six doses. An ounce of fœnugreek-seeds may likewise be given once a day in one of the mashes, and, when the purgation is over, continued for some time; or linseed may be used in the same manner, either in dry or moist feeds, until the horse grows smooth and well coated, and his dung moist or in good order.

COTTAGE, a small house commonly erected for the purpose of farming or other labourers who are connected with the business of husbandry. It has been well observed by a writer in the seventh volume of the Letters and Papers of the Bath Agricultural Society, that "as manual labour is and always must be necessary for the cultivation of land, it follows that houses for the habitation of those who are to perform that labour are indispensable. If, says he, the inhabitants of these houses are in health and able to work, they will be able to support themselves by the hire of their labour. If they are not, they become a burthen to the parishes to which they belong, and the laws will oblige the landholders to maintain them. To preserve the health and strength of these poor, but necessary fellow-creatures, is, therefore, says he, not only the duty but interest of the landholders. Men of feeling will endeavour to do this from principle. Men without feeling, if such men there are, will find it their interest to do it. The first step towards this necessary purpose is, that of providing proper habitations for them. Humanity shudders at the idea of an industrious labourer, with a wife, and perhaps five or six children, being obliged to live, or rather to exist, in a wretched, damp, gloomy room, of ten or twelve feet square, and that room without a floor; but common decency must revolt at considering, that over this wretched apartment there is only one chamber, to hold all the miserable beds of this miserable family. And yet instances of this kind, to our shame be it spoken, occur in every country village. How can we expect our labourers or their families to be healthy, or that their daughters, from whom we are to take our future female domestics, should be cleanly, modest, or even decent, in such wretched habitations? In order to remedy this serious grievance, more convenient and more numerous cottages should, he says, be built for the habitation of the labouring poor."

It is remarked by Mr. Beatson, in the first volume of Communications to the Board of Agriculture, that "there are different sorts of cottages, which require different constructions. Cottages of one, two, and three rooms. Some add cottages of four rooms; but these, says he, are seldom built, and are more in the style of houses of a superior kind. There are also cottages for the labourer, and for the mechanic of different trades, as carpenters, smiths, weavers, &c. each of whom would require a dwelling of a different construction. These different kinds of cottages may, he says, be divided into two classes, the plain, and the ornamental; but it is the former only which he means to treat of here, the latter being built chiefly as pleasing objects in different points of view from the parks or pleasure-grounds of noblemen and gentlemen of fortune. On these a considerable expense is sometimes bestowed; and, when executed and disposed with taste and judgment, they afford the most pleasing variety. Of this kind, the completest he has seen are at Lord Penrhyn's, in Cheshire, whose cottages are disposed with great taste, and adorned with surrounding clumps of planting, each having a pretty little plot of garden-ground and shrubbery in front, and some with honeysuckle and jessamine beautifully entwined round the porch and windows. The insides of these are equally delightful with the outside, being kept so excessively neat and clean, that it is a pleasure to view them. At the Earl of Winchelsea's, in Rutlandshire, are also, he says, some very neat cottages, kept in excellent order; but his lordship has been at a considerable expense in erecting them.

But the plain and simple cottage for the labourer being the chief object at present under consideration, he therefore endeavours to point out the most commodious and best construction for that sort of cottage, and the cheapest manner of executing them. It is found, he asserts, that an apartment 12 feet square is sufficiently large for a labourer and his family to eat in, and to hold besides all the furniture and utensils necessary therein. One sleeping apartment over that, partitioned in such a manner as to be most convenient to the family, and least offensive to decency at particular times, will constitute, he says, all the lodging required in a simple cottage. Upon these principles the following general rule for the construction of a small cottage may be laid down. Let *fig.* 1. in *pl.* XX. represent the ground-plan, 12 feet wide from a to b, and 16 feet long from b to c, within walls. From the length take 4 feet, $c\,d$, which will leave an apartment $a\,b\,d\,e$ 12 feet square, and a space $d\,e\,f\,c$ 4 feet by 12. Divide this space into two equal parts by the line $g\,h$. In one of these parts will be a stair to the upper apartment, and under it a small closet or cellar. The other part will serve for both a pantry and a milk-house. The upper chamber to be divided as shown in the annexed plans. The 4 feet space $d\,e\,f\,c$, taken off the length, may either be on the one end or the other; in a single cottage it matters not which. But as there ought always to be at least two cottages built together, being, besides other advantages, considerably less expensive in proportion than building them singly, that space ought, in his apprehension, to be taken from the extreme ends, by which the vents will be got in the middle wall that separates the two cottages. In most of the modern cottages he has visited (although many of them are

perfect in every other respect), the general complaint seemed to be, that the upper chambers were so excessively hot in summer, and so very cold in winter, they were scarcely habitable. This is owing, he says, to the thinness of a slate or tile roof, and to those chambers being so far within the roof. A proper thatched roof is therefore, he thinks, the best preventative of this evil, where there are upper chambers. If the roof is of tile or slate, which is by far the neatest and most durable, the ceiling should be lathed and plastered, and air-holes with shutters, so contrived that they may easily be opened or shut at pleasure, to give air to the whole roof in hot weather, which will tend greatly to keep the upper chambers cool in summer. Even a white sheet thrown over that side of the roof most exposed to the sun, or the roof itself whitened, will also have the same effect. In winter, if the angle in the roof be filled with straw, it will probably prevent the cold penetrating so easily.

The saving of fuel is certainly a material object to a cottager; and as it would be attended with a considerable additional expense to him, to keep a fire in the sleeping apartment above, as well as below, if a method can be devised to give the upper apartment some benefit from the fire below, it would surely, he observes, be of great advantage in cold weather. This might, no doubt, he says, be done by a flue; but some benefit may be derived from the vent being in the middle of the building, particularly if this vent is made as thin as possible where it passes through the upper chamber. If that part of it were made of plate iron, or such as is used in stoves on board of ships, it would add, he says, considerably to the warmth of the room. There is still another way that occurs to him that would have a good effect. In all apartments kept warm by a fire, it will be found that the air at the ceiling is considerably warmer than the air below. If, therefore, in a cottage, that warm air is permitted to ascend to the apartment above, it is natural to suppose it will render that apartment considerably warmer. This may be accomplished, either by means of sliding hatches, or by gratings in the least frequented part of the floor, made so as to open or shut easily when required. These methods of warming and cooling the upper chambers in cottages have probably, he says, never been tried, and are perhaps new; they may therefore be improved upon. At all events, they are at least worthy of being mentioned, if they can in any degree contribute to the comfort of the cottager. As every little space is of consequence in a small cottage, in order to make the stair within take up as little room as possible, there is, he says, a curious and uncommon contrivance in a cottage belonging to a very respectable gentleman in Cheshire. The stair in this cottage occupies only one half the space in ascending that a common stair does, as will be evident by the following explanation of it: *fig.* 2. *pl.* XX. is a front view of the steps; the width from *a* to *d* is 2 feet 5 inches; *a* is the first step, $7\frac{1}{2}$ inches high, upon which the left foot is put; *b* is the step for the right foot, $7\frac{1}{2}$ inches higher, but in the same line with *a*. The left foot is set on *a*, and the right foot on *b*, alternately to the top of the stair. It is therefore clear, that as the steps for the right and for the left foot are in the same line, and although neither foot rises each time higher than $7\frac{1}{2}$ inches, yet every time that one foot or the other is moved, it rises 15 inches higher than it was before, as will be more evident from the side-view, *fig.* 3. in which the dotted lines show the left foot-steps, and the whole lines the steps for the right foot. Suppose, says he, in a stair of this kind, that each tread or breadth for the foot is 9 inches, and that each rise of the one foot above the other is $7\frac{1}{2}$ inches, as in the figures; consequently as each foot rises the height of two steps, or 15 inches, every time it is moved, it is plain that six steps of this kind will rise as high as twelve in the common way, and will require only one half the size of a hatch or opening in the floor above, that would be required for those twelve steps as usually constructed. This will be of considerable advantage, where much is required to be made of little room, and will of course give more space to the chambers above. It is further observed, that in small cottages, where there happens to be a large family, a great deal of inconvenience often arises, especially when there is a mixture of boys and girls, in accommodating them with decency. This may, he thinks, be in a great measure remedied, by a different mode of disposing the beds from what is commonly followed. The method he would propose, is, to have one bed over another. Where it is thought proper to keep the boys separate from the girls, the entry to the boys' beds may be on one side, and to the beds for the girls on the other side, which will keep them as completely separate as if they were in two different apartments, as is shown in the annexed plans. It has already been mentioned, that two cottages ought always to be built together. To this it may be added, that every cottage should have an upper as well as a lower apartment. This latter opinion is differed from by many, but his principal reasons for recommending it are, because he conceives that upper apartments are more wholsome to sleep in than ground-floors; and, as the most expensive part of a cottage is generally the roof, a great deal of roofing will be saved by building one apartment over the other, and some walling besides.

In regard to the building of cottages, the least expensive way will be according to the nature of the materials on the spot. If plenty of stone is at hand, it will not only be the most substantial, but the cheapest material. Brick cottages are the most expensive of any. There is a method of building with earth, which, if properly executed, stands extremely well, and is very cheap. Almost any sort of strong loamy soil answers the purpose. If the soil is light or sandy, a little clay may be mixed with it; but clay itself is not so much esteemed for this kind of work, as it does not ram sufficiently hard, and is very apt to crack when drying; for the stability of this sort of wall depends greatly on being very hard rammed with a cast-iron rammer. He adds, that at Scarsbrick-hall, in Lancashire, there

is a garden-wall built in this manner. Mr. Ecclestone has also built an addition to his house, two stories high, in the same way. They are very well executed, and the surface so even and smooth, that, when rough-casted or white-washed, they cannot be distinguished from the finest stone wall. If carefully executed, these would, he says, make excellent and cheap walls for cottages. Another method of building earthen walls, practised, he believes, in some parts of Cornwall, is to take any sort of strong earth fit for making bricks; and to build the walls with it of the intended height and thickness; let them stand some time to dry; then fill within and round the outside with any sort of brushwood or combustibles, and set fire to them. It is said, that, when properly burnt, this makes a wall like one solid brick. The doors and windows are cut out afterwards, and the vents built of stone or brick.

In respect to the roof, the cheapest sort of material commonly used is thatch; and the best sort of thatch is a species of strong reed, found in some counties. The earl of Winchelsea has some sheds and farm-buildings covered with reed of this sort, which makes an excellent roof, and has lasted many years. There is, he says, still a cheaper kind of roof, but very little known. That is a brown-paper roof, well pitched. This makes an excellent light roof for many purposes, if properly executed. In the town of Dunfermline, in the county of Fife, he observes, there is a church with a roof of this kind, which has lasted near fifty years, with very little repair, excepting a new coat of tar every six or seven years. This church is 70 feet long, and 50 feet wide, without any intermediate support for the roof, of which the whole original expense of papering and tarring amounted only to 14*l*. A very cheap covering, surely, says he, for so large and so wide a building.

The deal flooring is another expensive article in erecting a cottage. In many places, a great saving may be made in the expense of this, he thinks, by adopting the plaster floor, recommended in a paper given to the Board, on farm-buildings. This kind of floor would answer remarkably well for a cottage; and being more retentive of heat than deals, might tend to keep the upper chamber warmer in winter, by attracting the heat of the fire below.

Mr. J. Wood, in a work intitled "A Series of Plans for Cottages," has thrown much light on the construction of habitations for labourers, and has laid down the following seven principles, as the means of obviating any inconveniences to which cottages, as usually built, are liable: 1st. The cottage, he observes, should be dry and healthy; this is effected by keeping the floor sixteen or eighteen inches above the natural ground; by building it clear of banks, on an open spot of ground, that has a declivity or fall from the building; by having the rooms not less than eight feet high—an height that will keep them airy and healthy; and by avoiding having chambers in the roof. 2dly. They should be warm, cheerful, and comfortable. In order to attain these points, the walls should be of a sufficient thickness (if of stone, not less than sixteen inches; if of brick, at least a brick and a half) to keep out the cold of the winter, or the excessive heat of the summer. The entrance should be screened, that the room, on opening the door, may not be exposed to the open air; the rooms should receive their light from the east or the south, or from any point betwixt the east and the south; for, if they receive their light from the north, they will be cold and cheerless; if from the west, they will be so heated by the summer's afternoon sun, as to become comfortless to the poor labourer, after an hard day's work; whereas, on the contrary, receiving the light from the east or the south, they will be always warm and cheerful. So, like the feelings of men in a higher sphere, says he, are those of the poor cottager, that if his habitation be warm, cheerful, and comfortable, he will return to it with gladness, and abide in it with pleasure. 3dly. They should be rendered convenient, by having a porch or shed, to screen the entrance, and to hold the labourer's tools; by having a shed to serve as a pantry, and store-place for fuel; by having a privy for cleanliness and decency's sake; by a proper disposition of the windows, doors, and chimneys; by having the stairs, where there is an upper floor, not less than three feet wide, the rise or height not more than eight inches, and the tread or breadth not less than nine inches; and, lastly, by proportioning the size of the cottage to the family that is to inhabit it; there should be one lodging-room for the parents, another for the female, and a third for the male children: it is melancholy, he says, to see a man and his wife, and sometimes half a dozen children, crowded together in the same room, nay, often in the same bed; the horror is still heightened, and the inconveniency increased, at the time the woman is in childbed, or in case of illness, or of death; indeed, whilst the children are young, under nine years of age, there is not that offence to decency, if they sleep in the same room with their parents, or if the boys and girls sleep together, but after that age they should be kept apart. 4thly. Cottages should not be more than twelve feet wide in the clear, that being the greatest width that it would be prudent to venture the rafters of the roof, with the collar-pieces only, without danger of spreading the walls; and by using collar-pieces, there can be fifteen inches in height of the roof thrown into the upper chambers, which will render dormer-windows useless. 5thly. Cottages should be always built in pairs, either at a little distance from one another, or close adjoining, so as to appear one building, that the inhabitants may be of assistance to each other, in case of sickness or any other accident. 6thly. As a piece of economy, cottages should be built strong, and with the best of materials, and these materials well put together; the mortar must be well tempered and mixed, and lime not spared; hollow walls bring on decay, and harbour vermin; and bad sappy timber soon reduces the cottage to a ruinous state: although he would by no means have the cottages fine, yet he recommends regularity, which is beauty; regularity will render them ornaments to the country, instead of

heir being, as at present, disagreeable objects. 7thly. A piece of ground should be allotted to every cottage, proportionable to its size; the cottage should be built in the vicinity of a spring of water—a circumstance to be much attended to; and if there be no spring, let there be a well. On the foregoing seven principles, he recommends all cottages to be built. They may be divided into four classes or degrees: first, cottages with one room; secondly, cottages with two rooms; thirdly, cottages with three rooms; and, fourthly, cottages with four rooms: plans of each of which, that have great merit in the form of their distribution, may be seen in his very able work.

The following are plans and elevations of the most simple kind of cottages for the labourer, on the principles that have been laid down, as well as others. Their roofs are represented as of slate, and other materials; the first being, however, by far the neatest. Their external appearance may be varied in different ways, according to the situation where they are built, which ought always to be attended to; for what will have a good effect in one place, or point of view, may not be so pleasing in another: but this will depend greatly on the taste and fancy of the builder.

For such small cottages as may be suitable for little estates, issuing out of allotments of wastes, or other lands, the following three plans of dwellings, to be built of different species of materials, are proposed by Mr. Crocker. The first is with mud walls, composed of soft mire and straw, well trodden together, and which, by degrees, is laid on, *stratum super stratum*, to the height required—a species of building not uncommon for cottages, and even for better houses, barns, &c. in the western and some other parts of the kingdom. It is, he says, the cheapest habitation that can be constructed, and is also very dry and comfortable. The second has generally a footing of stone-wall, two feet high, on which is placed a strong sill of timber; to which are superadded, uprights of quartering, two feet apart, into which are inserted rounds of rough wood, like ladder-work, at six or seven inches one above the other, to the height required. The spaces between the rounds are well filled with a mixture of mire and long straw, previously well trodden together, provincially called *cab-dab*: the whole is then plastered with good mortar, and rough-casted. These kinds of buildings are used where stones are scarce, or where cheapness is the leading object. The third is built with rough stone-masonry, and sometimes stuccoed over; and although it is more expensive than the others, yet it is the strongest and most desirable of any, where materials are to be had without great expense of carriage.

In *pl.* XIX. *fig.* 1. is represented the elevation of a small cottage, built with mud-walls; which, with a floor of earth, well rammed, may be erected (of the dimensions given) for the small expense of 27*l.*—the chambers of which may be lighted at the ends. At *fig.* 2. is seen the ground-plan of the same. At *fig.* 3. is represented the elevation of a cottage on a larger scale, which may be built of cab-dab at the expense of 58*l.* and at *fig.* 4. the ground-plan of the same. At *fig.* 5. is represented the elevation of a dwelling-house, suited to various purposes, which may be built of rough masonry, at the expense of 96*l.* and at *fig.* 6. the ground-plan of it.

Circular cottages, upon very cheap and economical plans, have likewise been lately proposed by Sir John Sinclair, for the purpose of containing farming and mechanical labourers. *Fig.* 7. shows the elevation of one of this model: *fig.* 8. is the ground-plan, and *fig.* 9. the chamber-floor. And at *fig.* 10. is the elevation of another somewhat larger: *fig.* 11. the ground-plan, and *fig.* 12. the chamber-floor.

At *fig.* 13. is the elevation of two cottages together, with the vents in the partition-wall betwixt them. *Fig.* 14. the ground-plan of these two cottages: *aa*, stairs to the upper chamber; *bb*, pantries, or milk-houses; *cc*, ovens.

And at *fig.* 8. *pl.* XX. the chamber-floor, showing different ways of placing the beds; *d*, apartment for the man and wife; *e*, beds, one above another, with the entries on different sides, as explained above.

At *fig.* 15. *pl.* XIX. a design is given for two cottages, contiguous to each other, by Mr. Holland; in each of which the smallest requisite for a family is adopted, because it contains all the principles which should be applied to buildings of any size, and because it is easier to enlarge than diminish the scale of any building for any purpose. These cottages contain four divisions or rooms: two on the ground-floor, and two over them. The first, marked *a*, *pl.* XX. *fig.* 9. serves for "kitchen and parlour, and all;" it contains the only chimney in the house, which should be large, with a high mantle-piece, so as to admit of sitting under it; the fire to be made on the hearth, and the chimney, above the mantle, large enough to hang meat or fish to dry. If an oven is required, the mouth of it should open through one of the jambs, and the body of the oven being in the house, will have advantages which will be hereafter noticed. The size of the chimney should admit of a pot hanging over the fire, so large as to preclude the necessity of a copper; which, besides its cost, would add an unnecessary consumption of fuel. The division adjoining this room, marked *b*, serves for a cellar, pantry, dairy, &c. for which purposes it is better that the floor should be sunk about sixteen inches, which will not prevent the run from the sink being made above ground, and directed towards the dunghill, or towards the necessary. The next division, marked *c*, *pl.* XIX. *fig.* 16. shows the one pair of stairs, is over the last, and is designed to be a lodging-room for children; and the last division, marked *d*, is designed to lodge the cottager and his wife.

The quantity of ground which should be allotted to a cottage of this description, admits, he says, of much speculation: perhaps it should be regulated by the goodness of the soil; and by considering how much it may be possible for the cottager to cultivate, without injury to the claims of his employer, who

purchases his daily labour, and has a right to nearly all that can be done. The distribution of it may be as in *pl.* XX. *fig.* 9.

In *pl.* XIX. *fig.* 17. is the elevation of a small neat cottage; and at *pl.* XX. *fig.* 4. is given the ground-plan of the same cottage; in which *a* is the stairs, with a small closet under it; *b*, the pantry or milk-house; *c*, the fire-place, which may have an oven at the side *d*, if required: and *fig.* 5. in the same plate is the plan of the chamber-floor: *e*, the apartment for the man and wife; *f*, a bed for girls; *g*, a bed for boys.

At *fig.* 18. *pl.* XIX. is the elevation of another small cottage, of a different form: and at *fig.* 6. *pl.* XX. is the ground-plan of the same cottage: *a*, the door; *b*, the pantry; *c*, the stairs; *o*, an oven, requiring a small projection without the wall, which must be properly covered to keep out wet. *Fig.* 7. is the chamber-floor of the same cottage: *d*, apartment for the cottager and his wife; *e*, two beds, one above the other. The entry to the bed below for the girls being at *f*, and the entry to the bed above for the boys, being on the side *g*. By making beds in this form, even with the entry to both on the same side, a large family may be accommodated in very little room.

The plan and elevation of a cottage, given by Mr. Crutchley, at *fig.* 19. *pl.* XIX. is thought by most cottagers to be the best, from the number of conveniences there are in it. But if this is built with mud-walls, with all the little comforts, it will cost nearly forty pounds. The ground-plan is seen at *fig.* 10. *pl.* XX. In this cottage, there are two sleeping-rooms over the living-room. At *fig.* 20. *pl.* XIX. is seen the plan and elevation of a double cottage, at Lord Penrhyn's, in Cheshire; and at *fig.* 11. *pl.* XX. is represented the ground-plan.

It is remarked by Mr. Holland, that building cottages must be attended with more or less expense, according to the facility with which materials can be procured, and the price of labour; and in some measure depend on the foundation that may be required, and the labour necessary to form the level on which they are to stand: but, supposing no extraordinary expense, the estimate will stand, he thinks, thus:—

	£.	s.	d.
18 yards digging the foundation, and levelling the ground, at 3*d.* per yard -	0	4	6
160 feet of reduced brick, rough stone, or flint, in the foundation, and one foot above ground, taking an average price, brick will probably be the dearest. When flint or rough stone is to be got, the least expense is to lay it in dry, and run liquid mortar, or, as the workmen call it, *grout*, to fill the interstices, and cement the work. It was thus the old hard walls, of which great remains are still to be seen, were constructed:—at 6*d.* per foot, 22 inches thick - - -	4	0	0
Carry forward	£4	4	6

	£.	s.	d.
Brought forward	£4	4	6
170 feet of reduced brick-work to the chimney and chimney-shaft, at 8*d.* per foot - - - -	5	13	4
608 feet superficial of earth or mud-walling, 20 inches thick, at 3*d.* per foot	7	12	1
1 square, 66 feet superficial, of flooring to the kitchen, if of earth, at 5*s.* per square - - -	0	8	3
78 feet of flat brick-paving, laid dry in the pantry, at 3*d.* per foot -	0	19	6
11 feet 3 inches of chimney hearth, paved with brick an edge in mortar, at 6*d.* per foot - - -	0	5	7½
33 feet of brick foundation to the privy, 9 inches thick, and two feet deep, open towards the dunghill, at 6*d.* per foot - - -	0	16	6
15 feet cube in a small brick sink in the pantry, raised 2 feet 6 inches above the floor, the run from it to the yard and privy, at 9*d.* per foot - -	0	11	3
16 feet run of brick gutter across the yard, at 3*d.* per foot - -	0	4	0
46¼ squares of the best reed-straw thatching on the house, including roofing of fir-poles, or rough unsawn timber, prepared for thatching, at 40*s.* per square - - -	9	10	0
3 squares of chamber-flooring, timber and boards, at 45*s.* per square -	6	15	0
3 squares of underflooring, serving as a security against fire, and a ceiling below, at 20*s.* per square - -	3	0	0
Mantle, tassels, and inside burn to kitchen chimney - - -	0	8	0
The staircase, one story - -	2	10	0
Three brick steps, with wood nosings, from the kitchen to the pantry -	0	5	0
The street ledged door, lintels, locks, latch, hinges, and door-cases -	0	19	6
The inside linings to ditto - -	0	4	0
The ledged door, door-case, lintel, hook, hinges, bolt, latch, and inside linings, from the pantry to the yard* -	1	0	0
The projection on the outside of the street-door, intended to shelter it from wind and rain, of boarding covered with lead - - -	1	6	0
No. 5. Inside ledged deal-doors, hinges, latch, and jambs - -	2	10	0
No. 4. Casement-windows, solid frames, lintel, lead lights, and inside window-boards - - - -	4	12	0
Outside fall-down shutter, and hinges, to one window, fastened with a pin and key - - -	0	6	0
Wood-bars to secure the pantry-window	0	1	6
Carried forward	£54	2	0½

* This door may, perhaps, be dispensed with, in cottages of the smallest size.

Brought forward	£54	2	0½
Outside painting to the window-frames, doors, and shutter - -	1	10	0
Skirting in the kitchen and two lodging-rooms - - -	3	0	0
A dresser and two drawers in the kitchen, with a shelf over it - -	2	10	0
Small dresser and shelf in the pantry	0	7	6
Closet shelves, and two closet locks	0	13	6
Lath and plaster to the ceilings of the lodging-rooms, and partitions -	1	5	0
Rendering against the walls in the kitchen only - - -	0	15	0
The white-washing in the inside, the colouring on the outside, and forming the rustics - -	2	2	0
Completing the privy above the brick foundation, and covering it with thatch	3	0	0
Building the hovel, covered with thatch, inclosed three sides with slabs, leaving an opening (for pitching fuel, or straw, &c.) next the street -	8	10	0
Fencing next the street, and small gate, &c. - - -	2	5	0
Total estimate for one cottage	£80	0	0½

The fencing to the garden, as well as making it, are not considered, as it must vary considerably in every situation. The supply of water is a sort of general concern, of which it is difficult to say how much will attach to a particular cottage.

This estimate is for a cottage of the smallest size. Perhaps buildings in the country may be thus divided, increasing in size and expense according to the order in which they are named:

Cottage, smallest size, for the labourer.

Second size, for the labouring man who, by his skill and working task-work, earns more than the common labourer.

Cottage, third size, for the village shopkeeper, shoemaker, taylor, butcher, and baker.

Cottage, fourth size, for the farmer, malster, small farmer, alehouse, and trades requiring room.

Cottage, fifth size, for the large farmer, generally called a *farm-house*, suitable to the most improved system of farming, but nevertheless partaking of the general principles already laid down. The expense of all such buildings will depend not only on the facility of procuring labour and materials, but on the economy and management of those who direct, and those who undertake the construction of them. It is not the least merit of the proposed plan, he observes, that the cottages of the smallest may be executed with the refuse of greater works, the "crumbs from the rich man's table," and that the materials are nearly all neither taxed nor taxable.

Pisè Cottage, that sort which is built of materials of the nature of rammed earth or clay, in what is termed pisè. See *Pisè*.

Cottage-*Farm*, a term lately applied to those small portions of land which are attached to cottages, in some districts. It has been proposed, by different writers on this subject, that where it is capable of being done, some portion of land should constantly be allowed to the holders of cottages, as much advantage may be derived from the practice, in the way of rendering the cottagers more comfortable and industrious, as well as in facilitating their means of supporting themselves and their families.

The great difficulty in this business, is in the mode of attaching such lands, and the quantities which are requisite in different instances, as they must obviously depend on a variety of topical circumstances, as the abundance or scarcity of land in the district, the methods in which it is managed, and the opinions of the holders of it in respect to such a system. There can, probably, be few situations in which a small proportion may not be afforded for this purpose; and in many it may, without doubt, be given not only without inconvenience, but with great benefit. Where the inclosures of extensive commons are made, it is a plan which seems extremely practicable, and capable of being readily carried into execution.

In support of this system of small cottage-farms, it has been ably observed by the Earl of Winchelsea, on the authority of Mr. Barker, of Lyndon, in Rutlandshire, that "most of the poor people of that parish keep cows, one, or two, or three to a family, which is a great advantage to them; so that it can hardly be said there are any industrious persons there who are really poor, as they are in some places where they have not that advantage. It has been the practice in that place time out of mind. They have a ground called the Cottagers' Close, wherein the poor, for an easy rent, keep eighteen cows, and, Mr. Barker supposes, it was laid out for them at the inclosure of the lordship in 1624. On that close, says he, the cows go from May-day till St. Andrew's, and in winter they take them into their homesteads; and, while several neighbouring lordships were open field, they could buy hay reasonably to feed them with at that season; and we have several little takes, of a few pounds a year, rented by the cottagers; and he has made some new ones; for since the inclosure of those parishes, hay is grown very dear, and is scarcely to be had at all. He believes, it always was the custom for every one to keep a milch cow, who could raise money enough to buy one, and could get keeping for it. He imagines it was so in this parish long before it was inclosed. —He thinks there are cottagers who have a right of a common in Hambledon cow-pasture: but supposes his lordship must know that matter much better than he does. There are little estates, and cottagers, who have a right of common in North Luffenham cow-pasture. There were persons at Edith Weston who had such before the inclosure, and he believes it was the same in other towns also: but, he is sorry to say, that he is afraid most of those cottages were taken away at the time of the several inclosures, and the land thrown to the farms; wherein, he thinks, they did very wrong: but they have, he says, an instance of a new inclosure, where that good old custom is still retained; as Sir John Rushout has

made a considerable number at Ketton. He believes the cow-pasture and ploughing-land to each cottage is four acres. He wishes that Parliament would make it a rule never to grant an inclosure, without a close laid out for the benefit of the poor."

It is added by his lordship, "that upon his own estate, the custom is, he believes, of the greatest antiquity: He has labourers, tenants, in whose families the lands they now occupy have been for near two hundred years; and they have, as far as he can learn, been generally good labourers, and received no relief from the parish. He has made several new takes of that sort, and has always found them to answer. And that, with regard to manuring their meadow-ground, by keeping their cows in hovels during winter, and by keeping a pig or two, which they generally do, they contrive to make manure: their employer generally sells them, or gives them, a small quantity of straw, and sometimes they procure ferne, or collect weeds."

On the whole, he thinks, that "the situation of labourers may be classed in this way:

"1st. Those who have a sufficient quantity of grass inclosed land to enable them to keep one or more cows winter and summer, and a garden near their house.

"This is, in his opinion, the best situation for a labourer, as, except the hay-making, the rest of the business is done by his wife, and his labour is not interrupted. Where a grass-field is allotted to a certain number, and each have a field for mowing near their house; or where there are two fields, one grazed, and one mown alternately, and properly stinted, it will be as advantageous, or nearly so, as having small inclosures to themselves." But he supposes it "can only take place in countries where there is an abundance of grass-land.

"2dly. Those who have a summer-pasture for their cow, and some arable-land, upon which they grow the winter provision."

He thinks, that "this is not so advantageous as No. 1. because more of their time is taken up by the arable-land: however, as they must, in order to make any hay, have part of the land sown with grass, the labour is not so much as to be hurtful to them. He has several such upon his estate, which answer very well. This is adapted to countries where there is a mixture of pasture and arable," he supposes.

"3dly. Those who have a right of common for the summer-keep of the cow, and a meadow, or arable ground, or a meadow in common, for the winter provision." And "this would, he thinks, be like the two former, were it not that nine commons out of ten are so much overstocked, that the summer-keep is very bad. This is a very great loss, and if the meadow is in common, it is another disadvantage. It is certain that upon an inclosure, if the owners choose it, the labourers who keep cows may be placed in a much better situation than they were, inasmuch as inclosed land is more valuable to occupiers of every description, than commons and open fields. Garden-ground may also be allotted to them, and others, which cannot be done while the land remains uninclosed. He is persuaded, that where these things are attended to, very few objections to an inclosure will arise on the part of the labourers, and that the land-owners will have the satisfaction of benefiting the poor, and at the same time of making their own property more valuable, by adopting what, in all probability, will be the means of keeping down the poor's rate. He supposes, gardens near the houses to all these; should not that be the case, as they have land, they may raise garden-stuff; but if their land is at a distance from their houses, it is not so advantageous: and if their take is all grass, they can find no ground to dig, except, perhaps, where a haystack has been placed the preceding year.

"4thly. Those who have a right of common and a garden. This is certainly very beneficial to them: geese and pigs may be kept upon the common; and the latter fed with the produce of the garden, and a small quantity of purchased food.

"5thly. Those who have a right of common, and no garden." He imagines, that "this, unless fuel is obtained, is of no great value to them; if fuel is obtained, it is of great value, and the loss of it difficult to be made up to them.

"6thly. Those who have several acres of arable land, and no summer-pasturage for a cow. This is, he believes, of no sort of use to the labourer; for though he may cultivate part of the land as a garden, the continued labour it would require to stall-feed a cow winter and summer, and the quantity of the land he must till would occupy so much of his time, that the take would, upon the whole, be injurious to him, even supposing the land inclosed, and contiguous to his house: if at a distance, or not inclosed, the disadvantage would be still greater. He is sorry to differ in opinion upon this subject from Mr. Barclay, but, perhaps, in other parts of the island, his plan of a take entirely arable might answer. He is persuaded it would not in the parts he is acquainted with, and that the farmers would not sell them hay, which is a part of his plan. He believes, that a summer-pasture for the cows is absolutely necessary, to make it of advantage to the labourers who keep them.

"7thly. Those who have a garden near their house." He asserts, that "this is the best thing that can be done for labourers in arable countries, and where there are other reasons which prevent them from keeping cows."

It is here remarked, that "as land cultivated as a garden will produce a greater quantity of food for man, than in any other way, and as four-fifths of the labour bestowed upon their gardens will be done by the labourers at extra hours, and when they and their children would otherwise be unemployed, it may not be too much to say, that 100,000 acres allotted to cottagers as garden-ground, will give a produce equal to what 150,000 acres cultivated in the ordinary way would give, and that without occupying more of the time they would otherwise give to the farmers who employ them, than the cultivation of 20,000 acres would require.

"8thly. Those who have no land whatever. This, it is observed, is a very bad situation for a labourer to be placed in, both for his comfort, and for the education of his children. When a labourer is possessed of cattle, his children are taught early in life the necessity of taking care of them, and acquire some knowledge of their treatment; and if he has a garden, they learn to dig and weed, and their time is employed in useful industry; by which means they are more likely to acquire honest and industrious habits, than those who are bred up in the poverty and laziness we too often see; for he believes it is a certain fact, that extreme poverty begets idleness."

On these grounds he is "clearly of opinion, that the letting land to labourers is of great utility both to them, to the land-owners, and to the community; for though in every village some idle people will be found, who are not fit to be entrusted with, or capable of receiving benefit from land, still the greater number will, and it may have the effect of making those industrious who would not otherwise have been so. When circumstances will admit of it, their having land enough to enable them to keep cows is the most desirable thing for them; but a very great part of the island will not, in his opinion, allow of that system's being pursued. Where there is hardly any thing but arable land, and also in the neighbourhood of large towns, the value of grass-land is too great, he supposes, to allow of labourers renting it with advantage. A garden may, however, be allotted them in almost every situation, and will be found of infinite use to them. In countries where it has never been the custom for labourers to keep cows, it would, he believes, be very difficult to introduce it; but where no gardens have been annexed to the cottages, it is sufficient to give the ground, and the labourer is sure to know what to do with it, and will reap an immediate benefit from it. Of this he has had experience in several places, particularly in two parishes near Newport Pagnell, Bucks, where there never had been any gardens annexed to the labourers' houses; and where, upon land being allotted to them, they all, without a single exception, cultivated their gardens extremely well, and profess receiving the greatest benefit from them. He begs to observe, that when he mentions cow-pastures, he always supposes there to be a sufficiency of land to enable the cow to be kept tolerably well, both in summer and winter. If this is not the case, he believes that the cow is but of little benefit to the owner; and when he mentions gardens, he always means large gardens, from half a rood to a rood, or more if the land is poor. Those very small spots of a few yards square, which are sometimes seen near cottages, he can hardly call gardens. He thinks there should be as much as will produce all the garden-stuff the family consumes, and enough for a pig, with the addition of a little meal. He also thinks they ought to pay the same rent that a farmer would pay for the land, and no more. He is persuaded, that it frequently happens, that a labourer lives in a house at twenty or thirty shillings a year rent, which he is unable to pay; to which, if a garden of a rood was added, for which he would have to pay five or ten shillings a year more, that he would be enabled, from the profit he would derive from the garden, to pay the rent of the house, &c. with great advantage to himself."

Much difficulty is supposed by the noble writer to be thrown in the way of the introduction of this cottage-farm system, by the disinclination of farmers to countenance such a plan. Under the present circumstances of the increasing wages of farming servants, it is, however, obviously their advantage to encourage them as much as possible.

In order to facilitate the introduction of this scheme of cottage-farms, and obviate the objections that have been brought against it, on the supposition of its not being practicable in arable districts, Sir John Sinclair has proposed the following plan and arrangement, in the fourth volume of Communications to the Board of Agriculture. In the laying down of which, he has these principles chiefly in view:—

"1st. That the cottager shall raise by his own labour some of the most material articles of subsistence for himself and his family.

"2dly. That he shall be enabled to supply the adjoining markets with the smaller agricultural productions: and,

"3dly. That both he and his family shall have it in their power to assist the neighbouring farmers, at all seasons of the year, almost equally as well as if they had no land in their occupation."

The writer thinks that "it can hardly be questioned, that, if it were practicable to have a number of cottages of this description, in every parish, it would promote, in various respects, the interest of the public."

I. *Extent of land necessary.*—On this he observes, that "unless the experiment were fairly tried, it is impossible to state exactly the extent of arable land requisite, to enable a cottager to raise the articles generally necessary for the sustenance of himself and family, and to keep a cow, some pigs, and poultry. Much must depend upon the natural richness of the soil (though, under the management about to be proposed, almost any soil would, in time, become fertile); on the nature of the climate; on the size of the cow; on the industry of the cottager; on the age and number of his family, &c. But he should imagine, that three satute acres and a quarter of good arable land, worth from 20*s.* to 30*s.* per acre, would be sufficient. It is proposed, that the three acres shall be under a regular course of cropping. The quarter of an acre ought, if possible, to be converted into an orchard, where the cow might occasionally pasture, and where a pond ought to be kept in good order, that it may have plenty of water at command. Were the land of a quality fit for lucerne, perhaps two acres and a quarter might, he thinks, be sufficient for the purpose."

II. *Stock and instruments of husbandry.*—He says, "it is evident, that so small an extent of land, as either two or three acres, under cultivation, excludes all idea of ploughing, and, indeed, unless the cottager shall manage the whole in the simplest and

cheapest manner, there is an end to the whole system. It would require, indeed, four or five acres to keep a single horse; and the expense of purchasing horses, or even oxen, ploughs, and other instruments of husbandry, must be far beyond the abilities of a cottager; whereas, with a spade, a hoe, a rake, a scythe, a sickle, and a flail, which are all the instruments really necessary, he is perfectly competent to the management of his little farm. It is suggested, that ploughs might, perhaps, be hired; but that, on the whole, the spade-culture is infinitely preferable; and he would much rather see a cottager hire persons to trench, than to plough for him."

III. *Course of crops, &c.*—It is suggested, that "the three acres proposed to be cultivated, should be divided into four portions, each consisting of three roods, under the following system of management:

	Roods.
Under potatoes, 2 roods; under turnips, 1* - - -	3
Under winter-tares, 2 roods; spring-tares, 1 - - -	3
Under barley, wheat, or oats -	3
Under clover, with a mixture of rye-grass† - - -	3
Total	12 roods."

It is added, that "other articles besides these might be mentioned, but it seems to him of peculiar importance, to restrict the attention of the cottager to as few objects of cultivation as possible." And "it is proposed, that the produce of the two roods of potatoes shall go to the maintenance of the cottager and his family;‡ and that the rood of turnips should be given to the cow in winter, and during the spring, in addition to its other fare."

That "the second portion, sown with tares (the two roods of potatoes of the former year, to be successively sown with winter-tares, and the turnip rood with spring-tares), might partly be cut green, for feeding the cow in summer and autumn; but if the season will permit, the whole ought to be made into hay, for the winter and spring-feed, and three roods of clover cut green for summer-food." And that "the third portion may be sown either with barley, wheat, or oats, according to the soil or climate, and the general custom of the country. The straw of any of these crops would be of essential service for littering the cow, but would be still more useful, if cut into chaff, for feeding it. The fourth portion, appropriated to clover and rye-grass, to be cut green, which, with the assistance of the orchard, will, he thinks, produce, on three roods of land, as much food as will maintain a cow and a calf for five months, namely, from the end of May, or beginning of June, when it may be first cut, to the first of November, beside some food for the pigs. It is supposed, that an acre of clover and rye-grass, cut green, will produce 20,000 lbs. weight of food for cattle. Three roods, therefore, ought to yield 15,000 lbs. weight. A large cow requires 110 lbs. weight of green food per day; a middling-sized cow, such as a cottager is likely to purchase, not above 90 lbs. consequently, in five months, allowing 1320 lbs. weight for the calf and the pigs, there will remain 13,680 lbs. for the cow. Were there, however, even a small deficiency, it would be more than compensated by the rood of land proposed to be kept in perpetual pasture, as an orchard." It is observed, however, that "these calculations are merely given as data for experiment. It must depend upon the season, whether the tares or the clover should be made into hay."

IV. *Mode in which the family may be maintained.*—On this it is stated, that "it is calculated, that three roods and eight perches of potatoes, will maintain a family of six persons, for about nine months in the year; but, according to the preceding plan, it is proposed to have but two roods under that article, for, however valuable potatoes are justly accounted, yet some change of food would be acceptable, and the cottager will be enabled, from the produce of the cow, and by the income derived from his own labour, and from that of his family, to purchase other wholesome articles of provision."

V. *Manner in which the stock may be kept.*—The writer supposes it evident, "from the preceding system of cropping, that ten roods of land, or two acres and a half, are appropriated to the raising of food for the cow, in summer and winter, besides the pasture of the orchard; and unless the season should be extremely unfavourable, the produce will be found not only adequate to that purpose, but also to maintain the calf for some time, till it can be sold to advantage. It is, indeed, extremely material, under the proposed system, to make as much profit of the calves as possible, as the money thus raised will be a resource, enabling the cottager to replace his cow, when a new one must be purchased." And that, "for the winter-provision of the cow, which is the most material, because summer-food can be more easily procured, there is the produce,

"1. Of about three roods of tares, made into hay.

"2. Of three roods of straw, deducting what may be necessary for litter; and if dry earth be put in the cow's hovel, and removed from time to time to the dung-hill, little or no litter will be necessary."

"3. Of one rood of turnips." It is supposed, that "the whole will be sufficient for seven months

* He would also recommend a small quantity of flax, where the culture and management of the plant was known, to employ the females, particularly in winter, and to supply the family with linen.

† "Some recommend the proportion, per acre, to be at the rate of one bushel of rye-grass to 12lbs. of red-clover; others, 14 lbs. of red-clover to half a bushel of rye-grass."

‡ By Sir John Methuen Poore's experiments, it was found, that half a rood, or one-eighth of an acre, produced, for several years, as great a weight of potatoes, as was sufficient for a family of four persons.—Four acres answered for 131 persons.

in the year; namely, from the 1st November to the 1st June; and during the remaining five months, the pasture of the orchard, some of the winter-tares, and the produce of three roods of clover and rye-grass, will not only suffice, but will furnish a surplus for the calf, if it is kept for any length of time*, and some clover for the pigs. The inferior barley, potatoes, &c. will of course be given to the pigs and the poultry."

VI. *Value of the produce.*—On this it is stated, that "the land thus managed will certainly produce, by means of the extra industry of the family, and at a small expense, a most important addition to the income which the cottager may derive from his ordinary labour. For instance,

	£.	s.	d.
1. The orchard (after the trees become fruitful) will probably yield per ann.	1	10	0
2. Three roods of turnips and potatoes	4	0	0
3. Eighteen bushels of barley, at 4s.	3	12	0
4. The cow and calf	7	0	0
5. Hogs	3	0	0
6. Poultry and eggs	2	0	0
Total	£21	2	0

He remarks, that "according to Mr. Kent's calculations, a cow should produce six quarts of milk per day, worth 1*d.* per quart, equal to 3*s.* 6*d.* a week, or 9*l.* 2*s.* per annum; setting the profit of the calf against the loss sustained when the cow is dry. But it is better to be rather under than over the mark."

It is added, that "where wheat can be raised, instead of barley, the profit would be still more considerable. Opinions will differ much, regarding the value put on each article, but that is of little consequence, as the total cannot be accounted too high."

VII. *Time required for cultivating the land.*—It is suggested, that "the quantity of land intended to be cultivated, will not materially interfere with the usual labour of the cottager. It will only require to be dug once, and is then fit to be cropped. It is proposed, that only nine roods shall be annually cultivated (the remaining three roods being under clover and rye-grass), and nine roods may be dug in the space of about 558 hours, or at the rate of 62 hours per rood. This might be done at bye-hours, more especially when the family of the cottager shall be somewhat advanced, and consequently more able to furnish assistance); but supposing that the digging, manuring, harvesting, &c. will require twenty entire days, per annum, in addition to the bye-hours, and allowing sixty days for Sundays and holidays, there will remain 285 days for the ordinary hand-labour of the cottager, which, at 1*s.* 6*d.* per day, would amount to 21*l.* 7*s.* 6*d.*; the earnings of the wife and children may, at an average, be worth at least 4*l.* per annum more. This is certainly a low calculation, considering how much may be got during the hay and corn harvests; but even at that moderate estimate, the total income of the family, will, he thinks, be as follows:—

	£.	s.	d.
1. Produce of the farm	21	2	0
2. Labour of the cottager	21	7	6
3. Earnings of the family	4	0	0
Total	£46	9	6

VIII. *Buildings.*—He says, "it is impossible to calculate the expense of building a cottage, as so much depends upon its size, the place where it is situated, the materials of which it is composed, the price of labour in the country, and a variety of other circumstances. On this important subject, much useful information is contained in the first volume of the Communications published by the Board of Agriculture. But it is proper to observe, that no expensive additional buildings will be necessary, in consequence of the proposed system. A shed or hovel for the cow, cannot occasion any very heavy charge; and a small barn, of the simplest and cheapest construction, may be of use, not only for threshing the crop, but also for securing the hay, and making it to more advantage, in case the season should prove unfavourable; if the corn is put up in small stacks, the barn may be made of very moderate dimensions."

IX. *Rent, and balance of income.*—On this head it is remarked, that "the rents of cottages, and of land, vary so much in different parts of the kingdom, that it is difficult to ascertain an average; but if the cottage shall be stated at 3*l.* per annum, the land at 25*s.* per acre, and the orchard at 10*s.* the whole will not exceed 7*l.* 15*s.* The cottager will also be liable to the payment of some taxes, say to the amount of 1*l.* 5*s.* more. Hence the total deductions would be about 9*l.* leaving a balance in favour of the cottager of 37*l.* 9*s.* 6*d.* Considering the cheap rate at which he is furnished with a quantity of potatoes, equal to several months consumption, and with milk for his children, surely, with that balance, he can find no difficulty, not only in maintaining himself and family, in a style of comfort, but also in placing out his children properly, and laying up a small annual surplus, that will render any parish assistance, whether in sickness, or old age, unnecessary; and thus he will be enabled to preserve that manly and independent spirit, which

* In a pamphlet, just published, by Richardson, Cornhill, on the culture of potatoes, the following mode of applying the refuse of potatoes, to the feeding of calves, is strongly recommended:

"Take two gallons of small potatoes, wash them clean, put them into a pot of boiling water sufficient to cover them, and let them boil till the whole becomes a pulp: then add more water, and run the whole through a hair sieve, which will produce a strong nutritive gruel. At first, use a very small quantity, warmed up with milk, to make it palatable to the calf, and increase the quantity daily, till it becomes equal. A quart of potatoe-gruel, and a quart of scald or skimmed milk, will be sufficient for a good meal, which should be given warm, three times a day."

it so well becomes a British cottager to possess." It is, however, here well remarked, that "the different expense of fuel in the various districts, will obviously greatly affect the annual surplus."

Advantages of the proposed system.—It is stated in conclusion, that "the advantages which may be looked for with confidence, from the proposed system, are that, in the first place, the land possessed by the cottager would be completely cultivated, and rendered as productive as possible. The dung produced by the cow, the pigs, &c. would be amply sufficient for the three roods under turnips and potatoes, which would afterwards produce, 1. Tares; 2. Barley; and, 3. Clover, with a mixture of rye-grass; in regular succession, without any additional manure. The barley should yield at least 18 bushels, besides 3 bushels for seed; and if wheat or oats are cultivated, in the same proportion. The milk, deducting what may be necessary for the calf, and for the cottager's family, might be sold in its original state, if there should be a market for it, or converted into butter, for the purpose of supplying the neighbouring towns or villages. Such cottagers, also, might certainly send to market both eggs and poultry." And that, "2. It is hardly possible to suggest a measure more likely to promote the benefit of a numerous and valuable body of people. The system of keeping cows by cottagers, which has been found so advantageous in the grazing districts, may thus be extended over the whole kingdom; and, indeed, if the above plan is found to answer, in place of 4 or 5 acres employed in feeding a single cow, it would be much better, even in the grazing counties, to restrict the land to a smaller quantity, under a tillage mode of management; for thus, not only the cow, but also the cottager himself and his family, would, in a great measure, be maintained by a less surface of soil." And, "3. It is supposed of infinite consequence, to establish the practicability of this system, as the means of removing a most unfortunate obstacle to the improvement of the country. It is well known to be the only popular objection to the inclosure of our wastes and commons, that, while uninclosed, a number of cottagers are enabled to keep cows, by the means of their common-rights, and that their cows disappear when the commons are inclosed. But if so small a portion of land as $3\frac{1}{4}$ acres, when improved and properly cultivated, can enable a cottager to keep a cow, even to more advantage than with a right of common, which can hardly be doubted, as he is enabled to provide winter as well as summer-food, there is an end to that obstacle to improvement. Indeed, if sufficient attention be paid to the principles above detailed, the situation of the cottager, instead of being deteriorated, would be materially bettered by the inclosure; and his rising family would be early accustomed to habits of industry, instead of idleness and vice."

The ingenious author "concludes with asking, if any one can figure to himself a more delightful spectacle, than to see an industrious cottager, his busy wife, and healthy family, living in a comfortable house, rented by himself, cultivating their little territory with their own hands, and enjoying the profits arising from their own labour and industry? or whether it is possible for a generous landholder to employ his property with more satisfaction, or in a manner more likely to promote, not only his own, but the public interest, than by endeavouring to increase the number of such cottagers, and encouraging, by every means in his power, the exertions of so meritorious, and so important a class of the community."

This interesting system of cottage-farming has been reduced into a tabular form, in the manner given below.

Plan of the Cottage-Farm, pointing out the Rotation of Crops in the different Lots.

Cottage.	The orchard, or perpetual pasture.	Pond.

Lot A. 3 Roods. 1 Year—2 roods potatoes, 1 rood turnips.	Lot B. 3 Roods. 1 Year—2 roods winter-tares, 1 rood spring-tares.
Lot C. 3 Roods. 1 Year barley, wheat, or oats.	Lot D. 3 Roods. 1 Year clover and rye-grass.

The Rotation of Crops for Four Years.

Year	Lot A.	Lot B.	Lot C.	Lot D.
1	Potatoes and turnips.	Winter and spring tares.	Barley, wheat, or oats.	Clover and rye-grass.
2	Winter and spring tares.	Barley, wheat, or oats.	Clover and rye-grass.	Potatoes and turnips.
3	Barley, wheat, or oats.	Clover and rye-grass.	Potatoes and turnips.	Winter and spring tares.
4	Clover and rye-grass.	Potatoes and turnips.	Winter and spring tares.	Barley, wheat, or oats.

"The rotation then begins as at first. Lot D. might continue in natural grass the first season, to diminish the labour of that year."

It is remarked, that "the exact period when the different crops should be dug or sown, cannot be ascertained, because it varies so much in different counties, and depends upon the seasons; but, according to the above rotation, the labour of digging the various crops is diversified as much as possible, so as not to interfere materially with the other occupations of the cottager. At no period would it be necessary for him to do more than two roods in a month: and both he and his family will labour with much more satisfaction and dispatch, when they work for themselves, than for another. In case of necessity, the cottager might hire some of his neighbours to assist him in digging, which would be much better than hiring a plough. If a cottager, under this system, could not work as a common daily labourer, he might, at least, answer as a useful labourer by the piece."

If this plan be found on trial to succeed, there can be no doubt but that, by being properly modified according to the nature of the situation, and the management in respect to cultivation, it may be applicable in arable as well as in grass districts.

It has been well remarked, by the noble earl mentioned above, that, "by means of these advantages, the labourers and their families live better, and are, consequently, more fit to endure labour: it makes them more contented, and more attached to their situation; and it gives them a sort of independence, which makes them set a higher value upon their character."

COTTAGER, a farming or other kind of labourer who inhabits a cottage. Labourers of this sort are indispensably necessary to the farmer, and without them much of his business must remain unperformed. It is justly observed by Mr. Beatson, in the first volume of the Communications to the Board of Agriculture, that nothing is more ruinous to the interests of the farmer than to keep a greater number of servants than he really has occasion for: yet, in all farms it is necessary there should be a fixed establishment of servants, in proportion to the extent and nature of the farm. Every one above that number may be considered as a supernumerary, incurring an unnecessary expense of at least fifteen or twenty pounds per annum, which will fall very heavy on the profits of almost any farm. This fixed establishment, however, is by no means sufficient to carry on the whole operations of the farm at all seasons of the year. There are certain times and certain operations that require additional hands; and fortunate is the farmer who can, on every such occasion, command a sufficient number to expedite and to accomplish his labours. It generally happens too, that when one farmer has occasion for a great many additional hands, all the other farmers in the neighbourhood have the same. How then are his operations, in this case, to be carried on? He must have hands, otherwise he cannot proceed, or at least may suffer a very material loss by delay. There are only three sources from whence he can expect assistance: from towns-people (if near a town), from villagers, or from cottagers. The townsman considers himself totally independent of, and unconnected with, the farmer; consequently, whoever gives him the best price, that is, bribes him highest, will purchase his labour: but, as it generally happens that those who will accept a bribe are little to be depended on, high wages, a great bustle, and little work badly executed, are therefore too often the consequence of applying to that source. The villager is also independent of the farmer, although somewhat more connected with him than the townsman. His demands, however, may not be so exorbitant; yet, being more accustomed to country labour, he will, no doubt, be of more utility, if he can be prevailed on to give his assistance. But the cottager is the main resource upon which the farmer can best depend: if, therefore, he is fortunate enough to have several well-peopled cottages upon his farm, he will have little to fear from a want of hands on extraordinary occasions. A ready supply of labourers is not the only advantage a farmer may reap from cottagers. He will have, at an easy rate, all the manure they make, except what they themselves may require for their little gardens; and they will often, perhaps, be the purchasers of several commodities he may have to dispose of, and save him the trouble to carry them to a more distant market. They will also sometimes have occasion for an additional quantity of ground besides their gardens, for which they will perhaps be enabled to give a better rent than even the farmer himself can make of it by keeping it in his own hands, or than can be expected from those at a distance; for, in general, land is the more valuable to the possessor, the nearer it is to his place of residence; and particularly so to the cottager, who can labour it at his spare hours, or when he is not otherwise employed. It is further remarked, that a nation is said to be rich in proportion to its population; so, he thinks, it is in a great measure with an estate, or a farm; for, the more numerous its inhabitants, the more easily will it be cultivated and improved. The erection of cottages is therefore an object of great importance to the farmer, as well as to the proprietor; but it is necessary for the mutual advantage of both parties, that the landlord and his cottagers should be on the best of terms; that he should regard them as a part of his own family, and that they should look up to him as their best and surest friend and protector. Every cottager should, therefore, consider, that in promoting the interests of his landlord, whether proprietor or tenant of the farm, he is, at the same time, promoting his own; for a landlord has it much in his power to serve and oblige his cottagers in various ways, as they themselves must be sensible of. If, therefore, they show that attachment and preference to his interest which he has a right to expect, there is no doubt he will do every thing he can to render their situation as comfortable as possible: but as it may sometimes happen, that even the

favours he may do them are not sufficiently binding on people of an ungrateful or refractory disposition, perhaps the most effectual way to secure to himself those benefits he is justly entitled to expect from their residence on his farm, would be, it is suggested, to make his rents conditional; that is, in case they do not give their assistance, when wanted in harvest, or on any other pressing occasion, they should pay so much more, and the farmer or proprietor to have it in his option to remove them at the first term of Candlemas, or Whitsunday, at which time the produce of the preceding crop will probably be removed from the ground they occupy, and their successor will have time to prepare for the ensuing crop. If settled on some such terms as these, he conceives the farmer would find it greatly to his advantage to have as many cottages on his farm as possible; and if he has a long lease, it would even be his interest to assist the proprietor in erecting new ones, either by driving the materials, or otherwise, as they can agree. In every spare corner, therefore, if a dry situation, of easy access, well sheltered, and near good water, a cottage should be built, and every encouragement given that can render the cottager and his family happy and comfortable. In many parts of the kingdom one great obstacle at present in the way of settling cottagers, is the poor-laws, as they now stand; every cottager and his family being supposed entitled to certain claims upon the parish in which they reside: but this might, perhaps, be obviated by passing a law, enacting, that in future, with certain exceptions and provisions, no cottager or others shall be entitled to make any such claims; or it might even, in some degree, be fixed by agreement with the cottager, at the time of his taking the cottage, by his entering into an obligation for himself and his heirs to renounce all claims whatever upon the parish. Such a law, or such an agreement, might, in all probability, he supposes, act as a sort of stimulus to industry: and might induce every father of a family to exert himself to make some kind of provision for his children or widow, in case of his death. Whereas, at present, by far too many take no sort of pains whatever to do so, being prepossessed with the idea, that, if reduced to beggary, the parish will provide for their families at their decease; and, trusting to the poor's funds, when often they have no occasion to do so, they squander away their little pittance at the alehouse, and dissipate all they earn as fast as they receive it. By some such regulations as these, he thinks, this great obstacle towards erecting cottages might be totally removed; and besides, the real necessitous objects of charity, if their funds were properly managed, would be more amply and comfortably provided for, and the poor's rates, at the same time, might be greatly diminished, and that heavy and intolerable burden upon the farmer and the community would consequently be more easily sustained. Every cottager should have a small garden annexed to his cottage, sufficient to raise vegetables for the family use. About twenty-five or thirty perches of ground, properly managed, would, he says, answer that purpose. Whatever more land the cottager may have occasion for, he thinks he should be dependent on the farmer for it. It is remarked by the Rev. Mr. Townsend, that he has observed a striking difference between the cottagers who have a garden adjoining to their habitations, and those who have no garden. The former are, he says, generally sober, industrious, and healthy, whilst the latter are too often drunken, lazy, vicious, and frequently diseased. The reason for this difference is obvious, because one fills up all his time with useful labour, whilst the other, for want of occupation, takes refuge in the alehouse, where he dissipates his scanty pittance, and destroys his health. And another striking difference to be noticed is, he says, between those who have freehold tenements, and their neighbours who are obliged to rent: in the former we commonly observe that openness and honesty which are seldom to be seen in men who are destitute of property. The peasant, whose ancestors built a cottage on the waste, with a sufficient garden, and the right of commonage for his cow, if he retain this little patrimony, brings up a numerous family without being reduced to the necessity of asking assistance from his parish. This man acquires habits of sobriety and industry, and his property is a pledge to the community for his good behaviour. These good qualities are transmitted to his offspring; and when his children go out to services, they, like their parents, are distinguished for ingenuous conduct: they resemble the sons of freemen, whilst the immediate descendants of those who have no freehold, too frequently have all the dispositions of a slave.

From these intelligent observations, as well as many others which are contained in the first volume of Communications to the Board of Agriculture, it is evident that cottagers are considerably benefited by having some portion of land annexed to their cottages; but what that quantity should generally be, is more difficult to ascertain. It is probable that the most advantageous plan would be to vary it according to the circumstances and situations of the places in which cottages are erected.

COTTER, a provincial word used to signify a sort of iron key to a bolt.

COTTERAL, a term signifying the same thing.

COTTS, a provincial word applied to such lambs as are brought up by hand. See *Cade Lamb.*

COTYLEDONS, the perishable side lobes of seeds, which for some time involve and supply nourishment to the embryo plants.

COUCH-GRASS, the name of an extremely troublesome sort of weed, and one of the most difficult to extirpate in arable land; every joint of its long-creeping roots being capable of quickly producing a new plant, after they have been broken by the plough. The most usual way of destroying it is by laying the land fallow in summer, and harrowing it frequently well over, to draw out the roots, every piece of which should then be burnt. Where this

is carefully done, the ground may be so well cleansed in one summer, that the remaining roots will not do any great injury to the ensuing crop: but the best way is to sow the land in which this weed prevails with such plants as require a frequent application of the horse-hoeing culture, or with such sorts of plants as are capable of keeping it from growing by their shade and closeness of stems. The blade of this grass is so rough, that the cattle will not feed upon it when green. Trench-ploughing is recommended by Mr. Young, in the Annals of Agriculture, as a proper method to destroy couch-grass; where he thinks one earthing given deeply with the skim-plough, and after that a hoeing system on the surface, the couch may be converted to a manure.

This weed is known by many different names in different districts, such as quitch-grass, twitch-grass, knot-grass, and dog-grass.

Couch-Grass *Drag*, an useful sort of tool employed in many districts for extirpating that troublesome weed. A good drag of this sort has been invented by Mr. Amos, and described and represented in his "Treatise on Agriculture and Planting," which, he thinks, is of vast importance in clearing land infested with such sort of grass, as it tears it up to the surface without ploughing the land or breaking the roots, and it can, with two men and four horses, drag fifteen acres in one day.

It is added, that when couch-grass is collected by the operation of the common harrow, after the second ploughing has been given, then is the time for using this machine. He advises to drag the land the length way of the ridges; then to harrow it once or twice, at the same time collecting the couch-grass into rows as much as possible with the harrows, rolling the land, and then gathering the couch-grass into heaps again by the couch-grass rake, and burn it. And if the land is very full of couch-grass, it may be proper to drag it across, then harrow and roll it as before, and afterwards gather the couch-grass into heaps again by the rake, and burn it. Further, to plough the land a third time, and, if any more couch-grass turns up, to harrow, drag, roll, and rake it once or twice before the fourth ploughing. When the coulters gather much of the couch-grass, they should be cleaned occasionally. And in cleaning them, one man lifts up the side of the drag, while the other man knocks the couch-grass off the coulters with the other handle.

Couch-Grass *Rake*, an implement contrived for extirpating this sort of weed from the land. An effective rake for this purpose has been invented and delineated in Mr. Amos's "Minutes of Agriculture and Planting." He observes, that this sort of grass is one of the worst of weeds among corn, and one of the most difficult to extirpate in arable land, as every joint of the root throws out a number of stems. The usual method of destroying it is, he says, by fallowing the land, harrowing, and rolling it well, and then gathering the couch-grass by hand into heaps, and burning it, which is not only very tedious, but expensive. But by the use of this machine and the couch-grass drag, the labour and expense is, he asserts, very much reduced. Between the second and third ploughings is the most proper time to begin the operation of cleaning the land of couch-grass.

He thinks, that the first thing to be done is, to make the land fine by rolling and harrowing, then to leave the land under impression of the roller, in order to level the surface, and to press down the clods out of the way of the rake. And the next is, to rake the land the cross way of the ridges, and when the rake has gathered as much of the couch-grass as it can hold without losing any of it, the man must lift up the handles so high, as to permit the couch-grass to fall off from the rake-teeth; the horse then going forward, he drops the rake just beyond the row thus gathered together. This he repeats as often as the rake is full, till he reaches the side of the field. He then turns, and coming back by the side of the part raked, empties the rake adjoining the first row. By this means, the couch-grass lies in straight rows, the length way of the lands. When the field is finished in this way as before, the rows must then be collected into heaps, forked over to lighten the couch-grass, and burnt.

It may also be advantageously employed in raking the hay upon meadow-ground into windrows, to be ready for putting into cock.

COUCHING, a term applied to the operation of destroying or cleaning land from couch-grass.

COUGH, in *farriery*, a convulsive motion of the lungs, being an effort of nature to throw up some offending matter. Horses are very subject to coughs, which are sometimes occasioned by colds, and often by the injudicious treatment of inflammations of the lungs; the consequence of which is frequently settled habitual coughs, which are said often to degenerate into asthma, and broken wind.

Nothing has perplexed practitioners more than the cure of settled coughs, the reason of which has probably been their want of properly attending to the different symptoms which distinguish one cough from another; as, without strict observance in this respect, it is impossible to proceed properly in the method of cure.

If a horse's cough is of long standing, attended with a loss of appetite, wasting of flesh, and weakness, it indicates a tendency to consumption, and that the lungs are diseased. But the following signs denote the cough to proceed from phlegm, or slimy matter, stuffing up the vessels of the lungs. The horse's flanks have a sudden quick motion; he breathes thick, but not with his nostrils open, as when in a fever, or when broken winded; the cough is sometimes dry and husky, sometimes moist, before which there is a wheezing and rattling in the throat, and sometimes great lumps of white phlegm are thrown out of his nose and mouth, especially after drinking, or in the beginning or ending of exercise; which commonly give great relief. Some horses when thus affected wheeze and rattle to such a degree, and are so thick-winded, that they can scarce move on, till they have been out some time in the open air, though then they perform beyond expectation. These are properly asthmatic cases, and ought to

be distinguished in their symptoms from that pursiveness and thick-windedness in horses, occasioned by too full, or foul feeding, want of due exercise, and their being taken up from winter's grass. The two last cases are easily cured by proper diet and exercise; the one by lowering the keep, and the other by increasing it.

The asthmatic cases often prove very obstinate; but, if they happen to young horses, and the cough is not of long standing, it is greatly relieved, if not totally cured, by the following plan: If the horses be full of flesh, bleed them plentifully; if low in flesh, more sparingly; which may occasionally be repeated, on very great oppression, or difficulty of breathing, in proportionate quantities. And as mercurial medicines are found remarkably useful in these cases, give a mercurial ball, containing two drachms of calomel, over night, and a common purge the next morning; or the following ball:

Take of gum-galbanum, ammoniacum, and assafœtida, each two drachms; of socotorine aloes, one ounce; of saffron, one drachm; of oil of aniseeds, two drachms; of oil of amber, one drachm; which form into a ball by a sufficient quantity of honey.

This remedy may be repeated at proper intervals, with the usual cautions. In the intermediate days, and for some time afterwards, one of the following balls may be given every morning:

Take of cinnabar of antimony, finely levigated, six ounces; of gum-ammoniacum, galbanum, and assa-fœtida, each two ounces; of garlic, four ounces; of saffron, half an ounce: make them into a paste for balls, with a proper quantity of honey.

These balls are well adapted to the purpose; but if they are thought too expensive, the cordial-ball may be given, with an eighth part of powdered squills and Barbadoes tar: or equal quantities of the above, and the cordial-ball, may be beaten up together; and where they can be afforded, balsam of Peru, balsam of sulphur, and flowers of benjamin, added to the cordial-ball, make it more efficacious in cases of this sort, as thus:

Take of the pectoral or cordial-ball, one pound; of balsam of Peru, half an ounce; of balsam of sulphur anisated, one ounce; of the flowers of benjamin, half an ounce; honey as much as is sufficient to form them into a paste: the size of a pigeon's egg should be given every morning.

Proper exercise in a free open air is very necessary, and the diet should be moderate. Horses that are subject to any inward oppressions of the lungs, should never be suffered to have a belly-full; that is, they should never be permitted so to distend their stomach with meat or water, as to press against the midriff, and thus hinder respiration. Their hay should be considerably abridged, and given in small quantities, sprinkled with water; and their usual allowance, both of corn and water, be divided into several portions: by such regulation horses may be so recovered as to do great service; in all disorders of the lungs, they are what should principally be attended to.

The following symptoms denote a dry cough, or asthma. The horses afflicted with this kind of cough eat heartily, hunt, and go through their business with alacrity, appear well coated, and have all the signs of perfect health; yet they cough at particular times almost incessantly, without throwing up any thing, except the violence of the cough causes a little clear water to distil from their noses. Though this cough is not periodical, yet some horses thus effected cough most in a morning, after drinking. This may properly be styled a nervous asthma, and is a case very doubtful at least, if not incurable: but when the horse is young, the following method may be successful:

Take away first a moderate quantity of blood; then give him two drachms of calomel, mixed up with an ounce of diapente, for two nights; and the next morning a purging-ball. Keep the horse well clothed and littered, and feed him with scalded bran and warm-water. Once in eight or ten days this purge may be repeated, with one mercurial ball only given over night.

The following balls may then be taken, one every day, about the size of a pullet's egg, fasting two hours afterwards; and should be continued for two months, or longer, to be of real service.

Take of native cinnabar, or cinnabar of antimony, half a pound; gum-guaiacum, four ounces; of myrrh, and gum-ammoniacum, each two ounces; of Venice soap, half a pound: the cinnabar must be finely levigated, and the whole mixed up with honey, or oxymel of squills.

The following may also be found useful in obstinate dry coughs:

Take of gum-ammoniacum, squills, and Venice soap, each four ounces; of balsam of sulphur, with aniseeds, one ounce; beat them up into a mass, and give as the former.

In conclusion, it may be observed, that some young horses are subject to coughs on cutting their teeth, their eyes are also affected from the same cause. In these cases bleeding is always necessary, and, if the cough be obstinate, should be repeated, with warm mashes; these, in general, are sufficient to remove the complaint. But when the cough is an attendant on worms, as it often is, such medicines must be given as have a power to destroy those animals; particularly mercurial physic, at proper intervals, and intermediately half an ounce of æthiops mineral, mixed up with the cordial or pectoral ball. See *Worms*.

Horses are not the only animals subject to this disorder: it is also very common among sheep, and young cattle, but no effectual method of cure has yet been proposed.

COUNTER, in *horsemanship*, the breast of a horse, or that part of his fore-hand which lies between the shoulders and under the neck.

COUNTER-*Fissure*, in *farriery*, a crack in the skull, opposite to where the blow was given; as

when a blow is received on the right side, and thereby a fissure is occasioned on the left.

COUNTER-*Marked*, in *horsemanship*, is when the teeth of a horse is artificially made hollow by a farrier's graver; and a false mark is made in the hollow place, in imitation of the eye of a bean, with the intent to make the purchaser think that a horse is not above six years old, and thereby conceal his age. See *Age of the Horse*.

COUNTER-*Opening*, in *farriery*, an operation which is sometimes necessary in wounds made by puncture, or a bullet, &c. to discharge what is contained in them, or to prevent their growing fistulous. The circumstances requiring this procedure are so various, as to demand the sagacity of the *farrier*: however, in general, the opening is made by passing a trochar, or such-like instrument, to the bottom of the wound, directing its point to the nearest skin, and continuing it through, so as to make the old and the new aperture one continued passage; or, secondly, by cutting through the skin, &c. directly upon the intruded body, or upon the button of the probe, which may be introduced to the bottom of the wound, to direct the incision in a proper manner.

COUPLES, a term applied to ewes and lambs.

COVERT, a term applied to a place sheltered, not open, not exposed.

COVEY, provincially applied to a cover of furz, &c. for game.

COW, a well-known useful animal, the female of the bull kind.

The marks of a good cow are these: wide horns, a thin head and neck, dewlap large, full breast, broad back, large deep belly; the udder capacious, but not too fleshy; the milk-veins prominent, and the bag tending far behind; teats long and large, buttocks broad and fleshy, tail long and pliable, legs proportionable to the size of the carcase, and the joints short. To these outward marks may be added a gentle disposition, a temper free from any vicious tricks, and perfectly manageable on every occasion. On the other hand, a cow with a thick head and a short neck, prominent back-bone, slender chest, belly tucked up, small udder or a fleshy bag, short teats, and thin buttocks, is to be avoided as totally unfit for the purposes either of the dairyman, the suckler, or the grazier. The most valuable cows are those which are bred in Yorkshire, Staffordshire, and upon the strong lands in other parts of the kingdom, which, being of the largest size, yield great store of milk, when turned on pastures where the grass is in sufficient abundance, or fed with a constant supply of such food as, from its succulency, conduces much towards the nutriment of the creature, and enables her to give large quantities of milk, such as turnips, grains, garden-vegetables, &c. But as these large cows require a more ample provision than would fall to their share on the generality of farms, it would seem that they should not be had by those farmers whose land is not of the most fertile kind; for, on ordinary keep, a small cow will yield a fairer profit than one of the Yorkshire or Staffordshire breed, which having been bred on the best kind of land, would be starved where a Scotch or a Welsh cow would find an ample supply of food. There is scarcely any farm which does not admit of keeping one or more of these animals of some sort or other; but regard should always be paid to the condition of the soil. Indeed, so necessary are cows in the economy of a farm, and their produce so very advantageous, that they can hardly be dispensed with.

A cow goes nine months with young; and where the herd is extensive, an account should always be kept of the time when each cow takes the bull, that she may be dried off at a reasonable distance of time before the expected term of gestation be completed. The proper time when the cow should be dried off is two months before her calving, when she ought to be suffered to lie quiet, and not be brought up with the other cows at milking or suckling-time; for, if a cow be continued in milk nearer to the time of calving than the period above allotted, it will not only greatly injure her future progeny by rendering it weakly and stunted, but will also have an ill effect on her own health. When a cow is four months gone with calf, the fact may easily be ascertained by pressing upon her off-flank, where the calf will be felt to kick against the hand. These animals generally show their desire for copulation, or taking the bull, by riding the other cows, and by the turgid appearance of their bearing.

And cows may be known to be near the time of calving, by springing at the udder or at the bearing. By springing at the udder is meant the collection of liquid in the bag, which, a few weeks before the time of gestation is accomplished, assumes in some degree the appearance of milk, and may be drawn from the teats. To spring at the bearing, is when this part is more than ordinarily large and distended. Heifers are said to spring soonest at bearing, and old cows at the udder. Cows sometimes slink their calves: and whenever this accident happens, care should be taken to keep the beast apart from the rest of the herd for a night or two, lest the other breeding cows should, by a kind of involuntary impulse, unfortunately do the same. This may be owing to accidents of different kinds; but some cows are peculiarly given to abortions: and where this happens, they should never be continued long in the herd, as being unlikely to yield any considerable degree of profit to the owners of them.

In the winter-time, if the weather be very cold, wet, and uncomfortable, cows which are shortly expected to calve, ought to be lodged at night in a large convenient out-house, or some other place, for a week or two previous to calving, as it may be the means of saving the life of the calf, and perhaps of its dam likewise: for, when a calf drops in the yard or field under such circumstances, the hazard of its perishing through the inclemency of the weather is very great, and it may considerably endanger the life of the cow. But if from inattention, or other causes, the creature should catch cold by calving abroad in sharp winter nights, (which may

be perceived by a refusal of her food, and by her trembling joints), she ought immediately to be driven into a warm shed, together with her calf, and fed with sugar-sops and ale, and with the best and sweetest hay, and should not be suffered to drink any cold water. By this treatment she will mostly recover in a few days; but should the disorder hang about her, balls composed of aromatic cordial substances may be given.

A milch cow is in her prime at five years old, and will generally continue in a good milking state till ten years or upwards; but this depends greatly on the constitution of the animal, some cows, like other animals, exhibiting marks of old age much earlier than others. See *Age of Neat-Cattle*.

There are four different purposes to which the produce of this animal is applied: the churn, cheese, suckling, and the immediate profit of the milk. This last constitutes the business which is termed cow-keeping. See *Cow-keeping*.

Where butter is the principal object, such cows should always be chosen as are known to afford the best and largest quantities of milk and cream, of whatever breed they may be. But the quantity of butter to be made from a given number of cows must always depend on a variety of contingent circumstances: such as the size and goodness of the beasts; the kind and quantity of the food; and the distance of time from calving. As to the first: it need scarce be mentioned that a large cow will give greater store of milk than one of a smaller size; though cows of equal size differ as to the quantity of cream produced from the milk of each: it is therefore on those cows whose milk is not only in large abundance, but which, from a peculiar inherent richness, yields a thick cream, that the butter dairy-man is to place his chief dependence; and where a cow is deficient in either of these, she should be parted with, and her place supplied by one more proper for this use. As to the second particular, namely, the kind and quality of the food: those who would wish to profit by a dairy ought to provide for their cows hay of a superior goodness, to be given them in the depth of winter, and this in an unlimited degree, that they may always feed till they are perfectly satisfied. And when the weather will permit, the cows should be indulged with an outlet to marshes or low meadow-grounds, where they may feed on such green vegetables as are present; which is far preferable to the practice of confining them the whole day on dry meat, and will enable them to yield greater plenty of milk, and will give a fine yellow colour to the butter even in the winter season. As to those who confine their milch cattle to the yard in the winter-time, when the weather will admit of their being turned abroad, or who fodder them chiefly on straw, they cannot expect to reap much advantage from these animals, whether kept for the pail, or for suckling: for, if the creatures be refused a due allowance of wholesome and nutritious diet, how can they be expected to yield any great abundance of milk? As to the third particular: those cows will certainly give the largest quantity of milk, and of a superior quality, which have calved the latest. Hence the necessity of providing a breed of cows, which, from their conformation, bid fair to fill the pail at every meal; and of limiting the number of the herd to the size of the farm, that they may always be supplied with succulent pasture: and from hence likewise may be adduced the propriety of attending to the peculiar property of each cow, that such as are not kindly for the pail, either by giving over their milk too early, or by continuing long dry, may be turned off for fattening; while those which yield the richest cream, are quiet and of a good temper, and which continue to give their milk to the latest period; which are not apt to slink their calves, and which are generally healthy, may be kept on the farm with the greatest emolument, till they become incapacitated by age to yield any further profit. From these cows it is, too, that such female calves should be made choice of, as are intended to be weaned, for the purpose of continuing the stock. This is a very eligible practice, and deserves the attention both of the suckling farmer and the dairy-man, as it will always be found that the cows which are bred on the land will be more kindly, under similar circumstances, than those which are bought in from other pastures; and, having sprung from a reputable stock, will rarely fail to answer the utmost expectations of the breeder, and in the end repay all the care and expense he may have been at in the rearing. See *Calf*.

Those who would make the utmost advantage from cows, either as sucklers, dairy-men, or milk-sellers, should always provide a bull to run in the herd, to obviate the perpetual trouble of driving them perhaps a mile or more to the bull, and in order to prevent the loss and inconvenience of their becoming frequently barren. One bull will generally be sufficient for twenty cows. These animals are in their prime at two years old, and should never be suffered to continue longer in a state of virility than to the fifth year; as, after that time, bulls which before were gentle and lay quiet in the cow-pastures are mostly apt to contract vicious dispositions, and become very unmanageable. Whenever this happens, they should be immediately castrated, and made stags. See *Stag*.

In the vales of Buckinghamshire and Oxfordshire, very great numbers of cows are kept for the purpose of butter. These fertile lands maintain a breed of large cows, which yield great store of milk; so that it is no uncommon circumstance for one farmer to keep a herd of fifty or sixty, and to collect a quantity of cream sufficient to fill a barrel-churn of sixty gallons in a week. The butter made from this cream is sold by the farmer or dairyman, to persons who make it their business to purchase this article at a stated price from Michaelmas to Lady-day, and at an inferior rate from Lady-day to Michaelmas. The butter thus collected is sent to London every week in waggons. It is consigned to the dealers, who retail it to the consumer; and no small profit from this traffic accrues to the waggoner and the butter-merchant. This butter is mostly made up in lumps,

containing the quantity of two pounds in each, and for that reason it has obtained the name of lump-butter. Its flavour is peculiarly sweet and agreeable, which is chiefly owing to the goodness of the pasture whereon the cows are fed; for this intrinsic merit would in vain be sought for in butter made from ordinary pastures, how great soever may be the skill of the dairy-woman. And though the grass should be equally luxuriant, the cows of the same breed, and the cream in like abundance, yet would a decided preference still remain in favour of the vale-fed cows; for, as a fattening beast on rich land will thrive much quicker than on thin soils, though the herbage be shorter on the former than on the poor ground, so will cows give a larger store of milk, and that of a more nutritious quality, when fed on deep fertile meadows, than if depastured on those of inferior goodness or quality.

But, besides the butter above-mentioned, large quantities are sent to the London markets from other places. Epping butter has long been held in the highest estimation. And great quantities are manufactured in Cambridgeshire and the adjoining counties. The Cambridge butter is sent in small pans; and has an additional quantity of salt mixed with it, to insure its keeping for ten days or a fortnight, and is generally perfectly free from any rancid taste. Yorkshire, Lincolnshire, and other neighbouring counties, where the land is rich and fertile, likewise supply large quantities of butter, which is salted and put into tubs for the southern markets.

In all those counties where the profit of the cow arises chiefly from the subsequent manufacture of the butter, the whole care and management of the article rests with the housewife, so that the farmer has little else to do but to superintend the depasturing of his cattle; the milking, churning, and, in short, the whole internal regulation of the dairy, together with the care of marketing the butter, where the same is made up wholly for home-consumption, falling alone upon the wife. In this department of rural economy, so large a portion of skill, of frugality, cleanliness, industry, and good management, is required, that without them the farmer, with the utmost care, and the most assiduous attention to his business without doors, may be materially injured through the imprudence or extravagance of his wife in the conducting his domestic concerns. This observation will indeed hold good in many other parts of business which pass through the hands of the mistress in a farm-house; but there is none wherein he may be so greatly assisted, or so materially injured, by the good conduct or want of care in his wife, as in this sort of dairy. See *Butter*.

Where cheese is the principal object, the management in respect to the cows must be the same. See *Cheese*.

When the object is the suckling of calves, the farmer should provide himself with a breed of cows suited to the quality of his land. Where the farm abounds with fertile pastures, watered with wholesome streams, and not far distant from the yard, so that the cows may be turned immediately out of the suckling-house upon their feed, the benefit will be in every respect superior to what can be expected from an arable farm, or where the green land is in a small proportion to the ploughed: for in this latter case, the cows must depend for their sustenance chiefly on the artificial grasses, as they are called, in many places; such as clover, trefoil, rye-grass, &c. which, besides that they are not properly adapted to the nature of this animal, will be subject to the further inconvenience of being frequently arrested in their growth by a dry summer, at which time likewise the ponds, if there are any in the uplands, will most probably be dry; so that the cows will be cut off from the enjoyment of solacing themselves in the water—an indulgence which they are very fond of, as in this retreat they find a shelter from the continual stings of the flies and other insects, and slake their thirst at their pleasure. Besides, by feeding in the uplands, they acquire a habit for roaming, and thus are eternally committing devastations in search of fresh aliment, not being easily restrained by hedges or other dry fences.

Where the land is fertile, so as to produce throughout the summer great store of pasture, and a sweet and wholesome fodder for the winter consumption, it may be advisable to purchase the larger breed of cows, such as those which are brought up from Yorkshire, Staffordshire, &c. But on poor soils, or where the arable land is in a larger proportion than the pasture, so that the cows must depend in a great measure on the production of the sown grasses for their support, the small North-Wales heifers will be found to answer every end desired from them, much better than those of a heavier weight. See *Calf-suckling*.

The cow-house, or shed, should be of a size adapted to the number of the beasts. Each cow should be driven into the house at suckling-time, and her head confined in a proper manner, having some fodder lying constantly before her, and a space left between every beast. When they become accustomed to this kind of restraint, they will without any trouble come into the places destined for them, when the calves may be suckled with the greatest ease and facility. See *Cattle-Sheds*, and *Calf-Pens*.

It has been observed by the author of Practical Agriculture, that "there is much difference of opinion in regard to the distance of time cows should become dry before their calving, some contending, that they may be milked almost to the time of their dropping the calf without injury; while others maintain, that it is absolutely necessary that they should be laid dry from one to two months, both for the advantage of themselves and their calves. It is probable that much in this business must depend on the manner in which they are kept; as where they are well fed they may be continued in milk till within a week or two of their calving, without suffering any injury whatever from it; but in the contrary circumstances it may be better to let them run dry for a month, six weeks, or more, according to their condition, in order to their more fully recruit

ing their strength. It appears, however, not improbable, but that the longer the milking is continued, the more free the cows will be from indurations and other affections of the udder; which is a circumstance deserving of attention. Where only one or two cows are kept for the supply of a family, it is likewise useful to know, that by good feeding they may be continued in milk without any bad consequences till nearly the time of calving. We have tried this method several times, without perceiving the least possible injury to arise from it. And in the Agricultural Survey of the West Riding of Yorkshire it is stated, that no advantage was found on trial to result from allowing the cows 'to go dry two months before calving.' They have there been kept in milk within ten days of the time of dropping the calf."

It is found, that "from accidents and other causes, it sometimes happens that cows slip their calves before they are sufficiently grown. Where this occurs, it is essentially necessary to remove such cows immediately from the cow-yards, or from mixing with the other cattle, for a few days. But where cows are much subject to such accidents, it is the best method to get quit of them as soon as possible, as they will seldom turn out profitable afterwards." This is fully shown above.

It is stated, that "where it is not the practice to bind up the cows in houses constructed for the purpose, especially during the winter season, which seems by much the best method, warm well-sheltered yards, with open sheds, should be provided, in order to protect the animals, and prevent their being exposed to the weather, as by such means they will afford much larger supplies of milk than where they are left in a state of exposure to wet and cold in open dirty yards, as is often the case. The bottoms of yards for this use should be well laid with some sort of hard materials, and the dung be frequently scraped off them, so as to keep them as dry and clean as possible. They should also have plenty of good clean water to drink of at pleasure. If due attention be not bestowed in these respects, which is seldom done, it is impossible that the advantages that might otherwise be the case can be derived from them."

In the keeping of cows, it "has been observed, that care should be taken to keep them constantly in good condition, as where they are ever suffered to become very lean, and that in the winter season, it is impossible that they can be brought to afford a large quantity of milk, by getting them into perfect condition in the summer months; as where cows are lean at the period of calving, no management afterwards is ever capable of bringing them to afford for that season any thing near the proportion of milk that they would have done if they had been supported in proper condition during the winter. Food of the most nourishing and succulent kinds should therefore be regularly given in suitable proportions in the cold inclement months, and the animals be kept warm, and well supplied with pure water, in the way just mentioned. Some advise their being cleaned by combing and other means; but this is a practice, which, though useful in making them yield their milk more freely, can perhaps seldom be employed on an extensive scale with advantage."

Cow-*Clags*, a provincial word applied to the clotted lumps of dirt that hang to the buttocks of cattle and other animals.

Cow-*Ground*, a word provincially applied to the cow-pasture.

Cow-*Herd*, a person whose office it is to attend upon and look after the herds of cows in places where they run in common.

Cow-*Herd Milk*, such milk as is received from the hands of the cow-herd.

Cow-*House*, a term often applied to the place destined for cows or other cattle.

Cow-*Keeping*, the business of keeping cows for the advantage of the milk, by disposing of it in large towns. It is a practice that can only be conducted with much benefit, where the supplies of necessary food can be readily provided; in other circumstances it would be improper to attempt it.

It has been observed, that "when the chief design of profit from cows is the immediate sale of the milk, which, near large towns, is certainly the most advantageous plan, if the circumstances of the farm admit of its being carried on—in general, the shorter the distance between the cow-yard and the place of sale, the more conveniently will this branch of business be conducted, and the larger the profits arising from it; so that such farmers as live on the skirts of a large town, enjoy the fullest advantage from the sale of their milk, and possess a preference in every respect over those who live at the distance of a mile or more from the place of sale. Such farmers will always give greater satisfaction to their customers, by supplying them with milk fresh from the cow, than the cow-keeper who lives at a distance, who has no such advantage; for the milk, having been perhaps half an hour or upwards undulating in the pails, will by that means have lost much of its original sweetness, and be totally unfit for keeping; nay, in hot weather, the jolting of the pails will have so much injured its quality, as to render it scarce fit for present use, allowing it to have been brought neat and unadulterated from the cow. Another disadvantage with which the country milkman has to struggle, is the greater expense in carriage; to which may be added the unbounded confidence he is, from necessity, compelled to place in the person who carries the milk, which it is great odds but he abuses, by purloining no inconsiderable part of his receipts. Yet, notwithstanding these disadvantages, a farmer, even at two miles distance from the place of sale, may find a larger profit accrue from this practice of selling the milk, than either from suckling or making butter, provided he can always meet with a ready sale, and at a good price: but if he has his milk frequently returned on his hands, or cannot even in the summer-season sell it at three-halfpence a quart, it will by no means be prudent to follow the practice.

"In this business, great regard should be paid to

the nature of the cows; which, as has been observed, ought to be adapted to the state of the pasture, or other kind of food. Where the green land is rich and fertile, as has been already observed, it may be stocked with the large Holdernesse and Staffordshire beasts, which will yield great store of milk at every meal: but such weighty cows demand a much more ample supply of nourishment than those of inferior size, so that not only the grass in the summer must be in the greatest abundance, and produced from pastures of the most fruitful soil, but the winter provision be also in equal proportion. When the weather will not admit the milking cows to be turned into the pastures in the day-time, and during the nights whilst they lie in the yard, they ought by no means to be stinted in hay, which should be the produce of the richest meadows, sweet and well made. Succulent food likewise of different kinds should be provided for them, in order to increase their milk, and enable them to yield the greater profit. To this purpose, turnips should annually be raised as contiguous to the yard as circumstances will admit, and a tub should never be wanting in the cow-house filled with fresh grains. These grains and turnips should be given alternately to the cows in troughs fixed under their yokes; and the cows should be driven into the house some time before milking, and allowed to remain there a small time afterwards. Neither is this allowance of succulent food less necessary for cows of inferior size; which, although they will thrive on more barren pastures in the summer, and with good well-flavoured straw in the winter season, require but a small portion of hay, and will eat greedily of ordinary fodder, and yield milk in abundance where cows of a larger carcase would refuse the meat, or fall off their milk: yet even in this case the like cautions are to be observed of baiting these small cows with turnips or grains in the winter, to prevent a decrease in the milk. But it is to be remarked, that these small cows consume either in grass, dry fodder, or other provender, a far less quantity than is required for the first-mentioned kind, and are therefore better adapted to every farm; those excepted, in which the pastures are of the richest and most fertile kinds. Among cows of this kind, kept for this purpose, there are degrees of size: but of these smaller beasts, those are to be accounted as proper for pastures where the soil is of a middling nature, such as the general run of marshes on the borders of the Thames, in Kent and Essex, which, when fattened, will arise to sixty stone. But on those of a more ordinary kind, Welsh cows of forty-eight or fifty stone are to be preferred; some of which are very good, and in proportion to their size will yield large meals of milk: though it must be confessed, that cows of a weight between this Welsh breed and the large Staffordshire and Holdernesse kind, such as mentioned above, are in general the most profitable; and where the land is so poor as not to afford a maintenance for these, it will rarely be found advisable to stock such ground with cows in the view of profiting from the pail. The necessity of giving the milch-cows grains during the winter months is another reason why the farm on which it is proposed to carry on this business should be situated near a large town; since it is necessary that these grains should be fetched twice or three times a week, in order that the cows may have them perfectly sweet: for they will refuse this diet with loathing when it has acquired an ill taste, which it will do in a very short time when the water is suffered to continue in the grains. The cow-keepers in the neighbourhood of London, where they have little else for the subsistence of their herds but grains and the produce of the gardens, have contrived a method of keeping the former in pits, which being filled with grains, and trodden tight down, are then covered over; and by this method they are preserved from the month of March till the summer, when the brewing is discontinued, at which time they are dug out perfectly sweet; the earth at top, and a thin covering from the surface of the grains, which may have contracted a mouldiness, having been first taken off. They may in like manner be kept in tubs or casks, which having holes bored at the bottom to let off the moisture, are to be placed on sleepers six or eight inches from the ground. By being closely pressed down in these tubs, the moisture passes off through the holes at the bottom; and the grains by these means may be preserved for several months without acquiring any ill taste: though to a country cow-keeper it will seldom be found necessary to keep them so long, since the only use which he has for grains is as a winter food. In the summer-time there will be a sufficient quantity of grass, the most natural aliment, and with which the cow-keepers about London cannot be supplied in a degree equal to the demands of their numerous herds. By this method of keeping grains in these reservoirs, the farmer may supply himself with this necessary article at times when he has little other employment for his horses; as in a frost, or in rainy weather, which may render the operations of the field impracticable or inconvenient: and whilst the weather permits the plough to work, it will not be necessary to take the horses off for the performance of these occasional jobs."

In the procuring of cows for this use, beauty of form is never to be attended to. It is chiefly the quantity of milk that is to be regarded; of course, all such cows as do not afford a full supply should be disposed of as soon as possible, as being very unprofitable in this sort of management.

In common, cows may be continued for a considerable length of time; but, "in the practice of cow-keeping, from the high manner in which the animals are kept, it is necessary to change them frequently. With respect to the exact length of time that they may be continued as milkers with the most advantage, it does not seem to be well ascertained by experiment; but it is probable that it cannot be more than two, three, or four years at the most, though much must undoubtedly depend upon the constitution of the animal. It is the best, however, not to keep them too long, as the vigour of secretion

is much less in old than young animals; and besides, they become more liable to swellings and indurations in the udders, as well as other diseases."

In the practice of cow-keeping in London, it is the custom "in two, three, or four days, according to circumstances, after the cows have calved, to send the new-dropped calves to be sold, as they would not be saleable before. The cows are thus left in full milk from within a few days of the time of their calving. But, in other situations, that cannot always be the case, as the demand for suckling-calves is less; they must therefore be often suckled by the cow-keepers."

It is observed, by the author of the Report of Middlesex, that "the cows kept for the purpose of supplying the metropolis with milk, are of a large size, and known by the name of Holdernesse cattle (from the district of that name in East Yorkshire), though they do not now all come from thence, but from the most perfect breeds of this stock in Yorkshire, and the neighbouring counties.

"The dealers in these cattle buy them of the breeders when they are three or four years old, and in calf. They expose them, says he, to sale at the fairs and markets in this county; particularly at Islington, where there is a fresh supply from the country every Thursday morning; by means of which, the London cow-keepers are enabled to keep up their several stocks. Many cows are likewise bought in the aforesaid counties, in lots of ten or twenty, by private commission, and forwarded to the cow-keepers in and about London. The prices given for them have generally been from ten to fifteen guineas; though, for the last two or three years, the price has increased to sixteen or eighteen, and is now (Feb. 1798) twenty, or more. The Holdernesse breed is supposed to give the largest quantity of milk; and, for that reason, is preferred by the cow-keepers, as quantity, independent of quality, is their object."

According to Mr. Baird, "the cow-keepers breed very few cattle, and those only from favourite cows, (which become so merely from their giving much milk), and with very little attention to the choice of their bulls. Even in summer, and when the grass is in the greatest plenty, the cows are regularly fed with grains; which, though the quantity of milk is thereby increased, by no means adds to its quality. The general allowance is forty-five quarters of grains per week (at 1*s.* 10*d.* per quarter) to every twenty-five cows. They are given them twice a day; and they have, besides, two meals of turnips and hay. Some cow-keepers have tried salt mixed with the grains; more with a view to preserve the grains longer in a sound state, than from any consideration as to the health of their stock, or the improvement of the quality of the milk. It is acknowledged, that the cows eat the grains so mixed with great avidity; but the proprietors not getting an adequate return for their trouble and expense, he does not find that it is now much practised."

It is stated by the author of Practical Agriculture, that "in this sort of business, the cow-keepers find great advantage in keeping the animals constantly fed with different kinds of succulent food, such as brewers' grains in a fresh unfermented state, turnips, cabbages, green tares, fresh cut grass, and soft green rouen, or hay that has undergone little or no fermentation in the stack;—By this means, much juicy matter is thrown into the system, and a continual varied stimulus kept up, by which a large increase of milk is produced. As the different articles thus employed must have less effect in exciting the secretory organs of the animals, in proportion to the frequency of their use, the utility of varying their food as much as possible, is rendered sufficiently obvious. On the same principle, there are probably various other substances, as well as these, that might be made use of with great benefit; but too few experiments have yet been made with them, in this view, to lead to any useful conclusions. There is another circumstance, however, that deserves the attention of the milk-farmer, in the feeding of his cattle, which is that of the dry food being properly proportioned to that of the green, or rich succulent kind, as, where this is not well attended to, the cows, by being kept in too lax a state of their bowels, from the great tendency which such materials have to run off in that way, may afford a much less quantity of milk than would otherwise be the case. We know, from repeated experiment, that considerable loss sometimes takes place in this manner. In the foddering of the cows, regard should also be had to supply them with the food in such a way as to excite the secretions in as regular a manner as possible. In this view, too much food should never be given at one time, but supplied more frequently, as three or four times, or oftener, in the course of the day. This practice will likewise, he thinks, have an advantageous effect in having the fodder more cleanly eaten up."

It is added, that "near Leeds, in Yorkshire, the milk-dealers, in some instances, feed their cows with cut grass, in the summer-season, and brewers' grains and oat-straw in the winter. And in the vicinity of Sheffield, the 'most experienced cow-keepers give five hundred weight of linseed-dust, mixed with three hundred weight of bran, per week, to six cows; others give a quarter of a peck of beans, with a peck of grains, for one feed for one cow, three times a day.' These are probably too expensive methods to be generally adopted; but as they are found to answer well, they may be employed with advantage in particular situations."

It is farther remarked, in the practical work just mentioned, that "the observations of Baron D'Alton, on the management of these animals, go to prove, by various accurate calculations, that a greater profit is capable of being derived from the keeping of them in the house, than in the usual method of allowing them to feed in the pastures. And the author of the Agricultural Survey of the West Riding of Yorkshire has remarked, that, by keeping cows upon red-clover and rye-grass, tied up in

the house in the day-time, during the summer-season, and putting them out after milking, in the evening, for the purpose of air and water, one acre of clover has been found to go as far as two when pastured; besides a larger quantity of milk afforded. The large portion of rich manure that is made in this way, is supposed to compensate any additional trouble or expense that may be incurred in cutting and conveying the food to the yards. In this method of keeping cows, as well as those with grains and other sorts of succulent food, it is constantly necessary to combine some sort of dry meat, such as hay, straw, or other similar materials, with the grasses. In soils where lucerne can be grown to advantage, it may be made use of with more benefit than the above; and, by combining other sorts of green juicy food with either of them, it seems not improbable, but that a still greater profit may be produced. Of the superior advantage of keeping milch cows in this method, there can be little doubt, when considered in different points of view."

It is stated by Mr. Foot, that "the number of cows kept by the London cow-keepers, in the county of Middlesex, amounts to nearly 7200; and in the counties of Kent and Surry, to 1300. During the night, he says, the cows are confined in stalls. About three o'clock in the morning, each has an half-bushel basket of grains. From four o'clock till half-past six, they are milked by the retail milk-dealers, who contract with the cow-keepers for the milk of a certain number of cows, from sixteen to eighteen-pence for eight quarts: this, however, varies with the distance from town. When the milking is finished, a bushel-basket of turnips is given to each cow; and very soon afterwards they have an allotment, in the proportion of one truss to ten cows, of the most grassy and soft meadow-hay, which had been the most early mown, and cured of the greenest colour. These several feedings are generally made before eight o'clock in the morning, at which time the cows are turned into the cow-yard. About twelve o'clock they are again confined to their stalls, and served with the same quantity of grains as they had in the morning. About half-past one o'clock in the afternoon, the milking commences in the manner above described, and continues till near three, when the cows are again served with the same quantity of turnips, and, about an hour afterwards, with the same distribution of hay as before described. This mode of feeding generally continues during the turnip-season, which is from the month of September to the month of May. During the other months in the year, they are fed with grains, cabbages, tares, and the foregoing proportion of rouen, or second-cut meadow-hay; and are continued to be fed and milked with the same regularity as before described, until they are turned out to grass, when they continue in the field all night; and even during this season they are frequently fed with grains, which are kept sweet and eatable for a considerable length of time, by being buried in pits made for that purpose, as described above. There are about ten bulls to a stock of three hundred cows. The calves are generally sent to Smithfield market, at one, two, or three days old. Good milkers are kept four, five, six, and sometimes even seven years, and are then dried, and fattened by the same kind of food as was given to them while they gave milk, and sometimes with linseed-jelly and distiller's wash, and are then sold off to the butcher.

The produce of these cows, and consumption of milk, Mr. Middleton estimates in the following way:

"From the facts adduced, it appears, he says, that there are about 8500 milch cows kept for the purpose of supplying the metropolis and its environs with milk; and, according to the information received, the quantity given by each cow, on an average, is nine quarts a day, equal to, per annum, 3285 quarts. The calf takes part of the milk for the first two or three days, during which time it would not be saleable; and there is a falling off for a few days before the cow calves: these occasion a deduction of about eighty-five quarts, leaving the annual saleable produce of each cow about 3200 quarts,

which, at the medium price of seventeen-pence for eight quarts, amounts to - -	£28	6	8
To which sum add for a calf, at two or three days old, from 20*s.* to 30*s.* the medium is about - -	1	3	4
and it gives the total annual produce per cow, about - -	£29	10	0

Which, 8500 cows, amounts to 250,750*l.* per annum.

The cow-keepers feed their cattle very high, in order to their producing the greatest possible quantity of milk. The expense is nearly as follows:

	£.	s.	d.
Turnips, 14 bushels per week each cow, at $2\frac{1}{2}d.$ per bushel, is - -	0	2	11
Grains, 7 do. at $2\frac{1}{4}d.$ per bushel -	0	1	$7\frac{1}{4}$
Hay, 1 truss, at 4-10ths per do. at 1*s.* 9*d.* per truss - - -	0	2	$5\frac{1}{4}$
[This may, perhaps, be deemed a low price to put the hay at; but it will not appear to be so, he says, if we take into the account, that the cow-keepers mow their land two or three times in a season, as their object is to procure the most grassy and soft hay they can. Hay of this kind would be hardly saleable at market.]			
Et cæteras - - -	0	0	$0\frac{1}{2}$
The expense of keeping a cow one week is - - -	£0	7	0

and per annum 18*l.* 4*s.* which, taken from 29*l.* 10*s.* (the produce as before stated), leaves 11*l.* 4*s.* for interest of stock, losses in cattle, the hire or support of horses and waggons, rent of buildings, attendance and profit."

The late Mr. Harper, of Bankhall, near Liverpool, made the following remark on the produce of a cow, and the expense of keeping her.—"He was informed by an industrious cow-keeper in Liverpool, that his cows average nine quarts of milk per day all the year through, which is sold at 2*d.* per quart, with the advantage of selling cream. But then, he says, there is a discount to be made; as, when the summer-months come in, there is often a great flow of milk comes out of the country, which reduces the average of both milk and cream to two-pence per quart the year through.

				£.	s.	d.
To 3235 quarts of milk, at 2*d.* per quart				27	7	6
To the average keep of a cow in grains, &c. for one year, at 4*s.* 6*d.* per week - -	£11	14	0			
To 160 stone of hay, at 8*d.* per stone - -	5	6	8			
To sixteen weeks' grass, at 3*s.* 6*d.* per week -	2	16	0			
Together -				19	16	8
Remains -				£7	10	10

for interest of stock, losses in cattle, and profit."

The consumers, Mr. Middleton says, "pay threepence halfpenny per quart to the retailers. If the latter were to sell the milk pure and unadulterated at this price, it would yield them a profit of 64*l.* 14*s.* per cent. But, in order to discover the actual profit of the retailers, we must add sixpence for short measure, and the extraneous articles mixed with it, which increases 2*s.* 4*d.* the usual price of eight quarts, to 2*s.* 10*d.*; and, as it costs them only 1*s.* 5*d.* there remains for labour and profit 100 per cent: thus the retailer clears 28*l.* 6*s.* 8*d.* by every cow. On the whole, they divide among them the unreasonably large sum of 240,833*l.*; and the sum paid for milk amounts to 481,666*l.*

"When the families of fashion are in London, for the winter-season, the consumption, and consequent deterioration, of milk, are, he says, at the highest. During the summer months, when such families are for the most part in the country, the milk may probably be of rather a better quality. The cream is taken from so much of it as remains unsold, and made into fresh butter for the London markets. The butter-milk is given to the hogs.

"The milk is always given in its genuine state to the retail dealers; and, as it is sold to them by the cow-keepers after the rate of two-pence and one-eighth of a penny per quart, and is retailed by them at threepence halfpenny per quart, the profit, says he, is surely so large as ought to prevent even the smallest adulteration. But when it is considered how greatly it is reduced by water, and impregnated with worse ingredients, it is much to be lamented that no method has yet been devised to put a stop to the many scandalous frauds and impositions in general practice with regard to this very necessary article of human sustenance. It is certainly an object well deserving the particular consideration of the legislature. It cannot be doubted, that many persons would be glad to make some addition to the price now paid for it (high as that price is), provided they could, for such increased price, procure so useful an article in domestic economy perfectly genuine.

"Five or six men only are employed in attending near three hundred cows. As one woman cannot milk more than eight or nine cows twice a-day, that part of the business would necesssarily be attended with considerable expense to the cow-keeper, were it not that the retailer, as before observed, agrees for the produce of a certain number of cows, and takes the labour and expense of milking on himself. Every cow-house is provided with a milk-room (where the milk is measured, and served out by the cow-keeper), and this room is mostly furnished with a pump, to which, he says, the retail-dealers apply in rotation, not secretly but openly, before any person that may be standing by; from which they pump water into the milk vessels at their discretion. The pump is placed there expressly for that purpose, and indeed is very seldom used for any other. A considerable cow-keeper in Surrey has a pump, he says, of this kind, which goes by the name of the *famous black cow* (from the circumstance of its being painted black), and is said to yield more than all the rest put together. Where such a pump is not provided for them, things are much worse, for in that case the retailers are not even careful to use *clean* water: some of them have been seen to dip their pails in a common horse-trough: And, what is still more disgusting, though equally true, one cow-house happens to stand close to the edge of a stream, into which runs much of the dung, and most of the urine, of the cows; and even in this stream, so foully impregnated, says he, they have been observed to dip their milk-pails.

"A cow-keeper informs him, he says, that the retail milk-dealers are, for the most part, the refuse of other employments; possessing neither character, decency of manners, nor cleanliness. No person could possibly drink of the milk, were they fully acquainted with the filthy manners of these dealers in it. The same person, he also observes, suggests, as a remedy for these abuses, that it would be highly proper for every retail milk-dealer to be obliged to take out an annual licence from the magistrates; which licence should be granted only to such as could produce a certificate of good conduct, signed by the cow-keeper, and a certain number of their customers; and also on their being sworn to sell the milk pure and unadulterated."

It is observed, in the Synopsis of Husbandry, "that of the several different ways of raising profit from milch cows, that of selling the milk, where circumstances will allow of its being carried on to a due extent, is by far the most eligible. In the economy of making butter and cheese, the trouble and expense is daily and perpetual. Several extraordinary domestics must be employed where the dairy is large: and no small allowance of fuel is necessary, that

boiling water may be still at hand, to scald the pails and other utensils employed on the occasion. In suckling, also, the charges are much heavier than when the milk is sold out of the pail; for sucklers are continually wanted, which are often bought in at very advanced prices, and sometimes these are not to be procured at any rate just when they may be required; so that either the calves which are ready for the butcher must be kept a week or two longer than would otherwise have been necessary, in which the farmer will rarely find his account; or, if these calves are sold off, there will be an overplus of milk, of which it will be found difficult to make any profit, since it will not produce a quantity of cream sufficient to make any advantage by the butter. Now the milkman, it is remarked, has none of these inconveniences to struggle with; and, whilst the cows continue to yield an ample produce, and this goes off at a quick sale, the whole of the business is performed with little trouble; and, what is an additional advantage, each cow yields a profit before her milk is sent to market, by the sale of the young calf; whereas the suckling farmer, as was mentioned before, is often under the necessity of purchasing such young calves to keep up his stock,—a balance greatly in favour of those persons who make sale of their milk."

It is further observed, that "on farms where there are many cows maintained, either for the profit of the milk, or the fatted calf, it will be often necessary, on a variety of accounts, to buy in fresh stock, either to supply the place of those which are rendered unfit for these purposes by age or accident, or to furnish an additional demand for milk, &c. In order, therefore, that the utmost emolument may be reaped from his profession, it will be convenient that the farmer do not embark further in the business than he can carry on to the greatest possible advantage; so that, whenever a cow is to be turned off, and another bought in to supply her place, a pasture may be in readiness to receive the former, where she may remain to fatten, or to recover from disease, as the case may be; whereas, if the farm be fully stocked with milch cows, those which are turned off must immediately be driven to market, and sold at a low price, to make room for their successors, which, in all probability, were bought in at a dear rate."

With whatever intentions these animals may be kept by the farmer, too much regard cannot be paid to their having their food and water as clean and pure as possible, and to their being rendered perfectly free from dirt and nastiness in the yards, stalls, and other places appropriated for them.

It has been asserted by some writers, that by exciting the secretion of milk by more frequent milking of cows, a larger proportion of milk might be obtained.

The following experiments, made with a view to this point, are recorded by Mr. Young, in the twelfth volume of the Annals of Agriculture, as having been instituted by Mr. Macro:

May 21st, 1789.	Pints.	October 22d, 1789.	Pints.
First meal - - -	$9\frac{1}{2}$	First meal - - -	11
Second ditto - - -	13	Second ditto - -	6
	$22\frac{1}{2}$		17
May 22d.		October 23d.	
First meal - - -	13	First meal - - -	11
Second ditto - -	8	Second ditto - -	3
Third ditto - -	5	Third ditto - - -	3
	26		17
May 23d.		October 24th.	
First meal - - -	12	First meal - - -	10
Second ditto - -	7	Second ditto - -	$1\frac{1}{2}$
Third ditto - - -	6	Third ditto - - -	$1\frac{1}{2}$
Fourth ditto - -	1	Fourth ditto - -	3
	26		16

A more varied set of experiments are necessary, in order to show fully the advantages that may be derived in this way.

Cow-*Lease*, pasture or meadow-ground kept for the purpose of feeding cows.

Cow-*Mig*, a word provincially used to imply the drainage of a cow-stall or dunghill.

Cow-*Pár*, a provincial word often applied to a cow-yard, straw-yard, or fold-yard.

Cow-*Tie*, a provincial term applied to a short thick hair rope, with a wooden nut at one end, and an eye in the other, being used for hoppling the hind legs of the cows while milking.

Cow-*Parsley*, the name of a plant common in pasture-grounds, and of which cows are said to be very fond. As this is one of the most early plants in shooting, its leaves by the beginning of April being frequently two feet high, it should be rooted out of all pastures: for the seeds, if it be suffered to stand long, spread greatly over the ground; and, besides, as the roots are perennial, they are often very troblesome to destroy.

Cow-*Parsnip*, the name of a plant that grows to near three feet high. The stalk is round, furrowed, and hollow. The leaves proceed from a large membrane or sheath. They grow on long hairy stalks, and are divided and downy. The flowers grow in large umbels, are white, and consist of five irregular petals: two oval, streaked, compressed, surrounded by a wing, succeeding each flower. This, which is a troublesome plant in some lands, is frequently known by the different names of *wild parsnip*, *meadow-parsnip*, and *madrep*.

Cow-*Pox*, in *farriery*, is a disease affecting the teats, and contagious in so far as it often is propagated to other cows by the hands of the milkers. This disease appears in the form of blue vesicles surrounded with inflammation; the animal is indisposed, and the secretion of milk lessened. Vesicles similar to those on the nipples of the cow, but less blue, appear on the hands of the milkers, attended with febrile symptoms, and frequently with tumors of the axillæ. Vesications of the same kind may also take

place in any other part, in consequence of inoculation by the fingers of the patient, impregnated with virus. These vesicles, produced by the casual infection, whether in the human subject or the brute animal, often degenerate into troublesome ulcerations, unless proper applications be employed. Those in common use are solutions of *cuprum vitriolatum* and *zincum vitriolatum*. Saturnine applications, however, will in all probability be found preferable, and more generally useful.

Morbid virus of various kinds is capable of exciting a disease bearing some resemblance to the above; but the genuine cow-pox, according to Jenner, consists of *vesicles*; the spurious of *pustules*. These have neither the blueness nor the central depression which characterize the former; nor are they so infectious, nor so likely to be followed by obstinate ulcers, as the genuine kind.

It is remarked, that "the spurious cow-pox originates from common inflammation, whether occasioned by neglect of milking, luxuriant food, the sting of an insect, or any other cause. This affection is but rarely communicated to the hands of the milkers; and only deserves to be mentioned on account of the possibility of its being mistaken for the genuine species of the cow-pox. It is, indeed, so benign, that, in many places where it is well known, no idea is entertained of its being contagious; and it may reasonably be doubted whether it really is so, till the matter which the pustules contain has undergone decomposition."

This disease is described by Dr. Sacco, a physician at Milan, "as consisting of little tumors, depressed in their centers, of a shining appearance, and reddish brown colour, containing a thin inodorous fluid, which thickens, and forms an incrustation. These incrustations become of a deep red; and the cows suffer great pain at the time of milking. This distemper, which is not very commonly observed, is attended with diminution of appetite, a continual rumination without any materials in the mouth, and a motion of the lips resembling that of a person playing on a flute. The milk is lessened; the eye downcast. There is a slight symptomatic fever. The pustules are seated on the nipples, and the lower part of the udder: sometimes, but rarely, a few appear about the eye-lids and nostrils. This species of distemper, he observes, is contagious to such a degree, that, if one cow contracts it, in the course of ten days the whole herd will be infected."

In the cure of this disorder, it is suggested in Boardman's Dictionary, that "it is probable that the early application of lunar caustic, blue vitriol, or verdigrise, with a view of eating off the infected surface of the ulcer, after the cuticle has given way, would be useful. And as the cause of its propagation to the rest of the herd is well known, the milker of the infected cow, as well for his own sake as for that of his employer, should carefully wash his hands with soap and water after each milking. For the ulceration which has been called the spurious cow-pox, alum-water, or any other detergent lotion, may suffice for its removal."

Cow-*Wheat*, is a pernicious weed in many countries. Its seed is something like wheat; and, according to Clusius, spoils the meal with which it is ground, by giving it a dark colour and a bitter taste: though Mr. Ray says, he could never perceive any disagreeable relish in the bread with which it was mixed. Mr. Miller observes, that it is a delicious food for cattle, particularly for fattening of oxen and cows, and that it may be worth while to cultivate it for that purpose. Its seeds seldom grow the first year, unless they chance to be sown, or sow themselves, in autumn, soon after they are ripe. It is sometimes known by the name of *fox-tail*. See *Meadow Fox-tail*.

COWL, a term employed in some districts to signify a tub; especially that which is used in making cheese.

Cowl, a word applied provincially to raking or scraping any thing up together.

Cowl-*Press*, a term provincially used to signify a lever.

Cowl-*Rake*, a provincial word applied to an implement for raking dirt or mud with. It is sometimes pronounced cow-rake.

CRACKS *in Heels of Horses*, in *farriery*, little clefts which are said to be sometimes constitutional, but more frequently local, and owing to the want of cleanliness and proper attention on the part of the groom. When the heels are full of hard scabs, is is necessary to begin the cure by poultices made either of boiled turnips and lard, with a handful of linseed powder, or oatmeal and rye-flour, with a little common turpentine. Digestive ointment being applied to the sores for two or three days, with either of these poultices over it, will, by softening them, promote a discharge, unload the vessels, and take down the swelling; when they may be washed with the following lotion:

Take of vitriolated zinc, burnt alum, of each two ounces; ægyptiacum, one ounce; lime-water, a quart or three pints.

The sores should be washed with a sponge dipped in this three times a-day, applying the common white ointment, spread on tow, to an ounce of which may be added two drachms of sugar of lead, over it.

Sand-Cracks, in *farriery*, a term applied to a particular sort of cracks in horses' feet. See *Sand-Cracks*.

CRADLE, a kind of bow which is sometimes fixed to a scythe, the better to gather the corn, when low, into swarths when it is mown.

CRAG, a term applied to large rocks of calcareous or other stones in the northern parts of the kingdom.

Crag, a name given in some places to the remains of marine shells of various kinds, and of which the greater part of cliffs mostly consist.

It is a sort of shell-marl, being chiefly shells whole, or in a decaying state, mixed with calcareous earth, which probably is nothing but the shells perfectly decayed. The benefit of it, in Suffolk, for turnips, on a poor sand, has been found equal to that of dung; yet the greatest effect was on a moory

bottom. The Sandlings, a tract of ground in that county, near Woodbridge, seems to be upon a foundation of this red shell-marl, or crag. There are very large deep pits on every farm in this district, whence immense quantities were dug for its improvement, when first broken up from its waste state of heath, at 4*d.* an acre, to fields covered with fine crops of turnips, carrots, and corn, at 5*s.* 10*s.* and 15*s.* an acre. The use of crag is, however, dropt there, except for taking in walk-land, as they call it, or sheep-walks. On old improved lands, they never lay it on alone, but mix it with dung, earth, or ooze, thinking that it makes light lands blow more. Mr. Young, in his Eastern Tour, says that crag is dry, and not in the least soapy; that it does not effervesce in acids, and does not fall in water; that notwithstanding this, all the effects, and even more, produced in Norfolk by sixty, eighty, and one hundred loads of marl, are gained in Suffolk by ten or twelve of this; and that it lasts even longer, which they have discovered from an idea, probably a false one, that land once cragged will not bear a repetition of it, except in a compost with dung; and accordingly they have many fields, in which it has lasted, with such additions, fifty, sixty, and even one hundred years. The nature of the poor sands in that country is quite changed by it, and they gain an adhesion which they retain for ever. It is also a great fertilizer, as appears from the great and sudden increase in the crops after its application.

CRAKE, a name applied in some of the northern counties to the crow.

CRAKE-*Needle*, the plant termed shepherd's needle.

CRAMBLES, a provincial word used to signify the large boughs of trees, from which the faggot-wood has been cut.

CRAMP, in *farriery*, a local spasm of the muscles of a part, accompanied with violent pain, which ceases in the intervals when the spasm is absent. Horses are liable to be seized with cramp in their hinder legs; and sometimes universally. Their removal may, probably, be best effected by mercurial purges, bleeding, opium, the warm bath, and topical stimulants.

CRANE'S-BILL. See *Crowfoot.*

CRAP, a name given in some places to darnel; and in others to buck-wheat.

CRAPULA, in *farriery*, a distended state of the first stomach of a ruminating animal, in consequence of having eaten too freely of flatulent food. It is common to horned cattle. See *Hoven.*

CRATCH, a term that in some places signifies a rack.

CRATCHES, in *farriery*, a swelling on the pastern, under the fetlock, and sometimes under the hoof of a horse; for which reason it is distinguished into the sinew-cratches, which affect the sinew, and those upon the coronet, called *quittor-bones.*

CRAZEY, a word applied to the weed called creeping-crowfoot. This, in the vale of Gloucester, is, according to Mr. Marshall, esteemed as a valuable species of herbage, while the common and bulbous species are considered as extremely pernicious, especially among hay, which is, he thinks, a distinction that does the vale farmers much credit; as the fact appears, he says, to be, that the two latter are extremely acrid, and probably have a caustic effect on the mouths of the cattle which eat them; while the first is perfectly mild and agreeable to them. This is, probably, a circumstance not generally known.

CREAM, the unctuous or oily part of milk, from which butter is made. See *Dairy.*

CREAM-*Slice*, a word applied to a sort of wooden knife, twelve or fourteen inches in length, somewhat in the shape of a table-knife.

CREEL, a provincial word used to signify a sort of bier used in salving or smearing sheep, and for slaughtering them, as well as other animals upon.

CREPITUS, in *farriery*, is a crackling of the joints, from a defect of synovia, or other causes. Also a noisy discharge of air from the anus of animals.

CRESCENT, in *farriery*, is when, in the horse, the point, or that part of the coffin-bone which is most advanced, falls down and presses the sole outwards, and the middle of the hoof above the toe shrinks and becomes flat, by reason of the hollowness beneath. These crescents are in reality the bone of the foot, which has left its place, and is fallen downwards, so that the under part of the foot, that is of the sole and the toe, appears round, and the hoof above shrinks in.

CREST-FALLEN, in *horsemanship*, is that imperfection in a horse where the upper part of his neck, on which his mane grows, called the *crest*, hangs either on the one side or on the other; not standing upright, as it ought to do. It proceeds for the most part from poverty, caused by ill keeping, and especially when a fat horse falls away suddenly through sickness. A cruel operation is practised by horse-dealers to remedy this; but the most rational and humane way is to restore the horse to his former condition by good keeping, and other management.

CRIB-BITING, in *farriery*, a vice to which some horses are subject; consisting in their catching hold of the manger, and sucking in the air, till they are so full that they are ready to burst. Some do it only on their collar-reins, and some on every post and gate they come at.

It is a vice more common to horses in London than any where else, and may either arise from very low feeding, whilst they are young, or, perhaps, by standing much at the crib whilst they are shedding their teeth; for then their mouths are hot, and their gums tender and itching, which may readily make them suck in the air to cool their mouths: but young horses are most apt to acquire this ill habit when they stand next those that do it. Horses when addicted to this vice are but of small value; as they mostly drop a great part of their food unchewed, which makes them always look lean and jaded, with a staring coat. It is a habit very difficult to be removed.

The best method is to put a little straw into the manger, to prevent his biting it, and to abridge his allowance of hay; or you may put him by a wall where there is no manger, and lay his hay on the ground, and give him his oats in a bag. If this practice is pursued for any length of time, it will effectually cure him of this very pernicious habit.

CRIBBLE, coarse sort of meal, or such as is but one degree better than bran.

CRICK, in *farriery*, is when a horse cannot turn his neck any way, but holds it fore-right, insomuch that he cannot take his meat from the ground without great pain. Rowels have been recommended; but blistering, and the application of spirit of turpentine, will probably answer the purpose much better.

CRINGLE, a provincial word applied to a withe or rope, for fastening a gate with; hence, to cringle up signifies to fasten with a withe.

CROFT, a term applied to a small field or inclosure. In the northern counties, for the most part, one end of it contains the dwelling-house and kitchen-garden. It sometimes also signifies a common field.

CRONES, a provincial word applied to the different descriptions of old ewes. It is observed by Mr. Young, in his Calendar of Husbandry, that it is the common system in many inclosed districts, to buy old crones in September, to put the ram to them in the following month, and to dispose of the lambs as they become fat for the butcher; afterwards fattening the mothers, and clearing the whole within or in about a year from the time of buying. This he considers as a tolerable system, where the fences are quite secure, and food very plentiful; but, in general, inferior to that of wether lambs.

Mr. Marshall, in his Minutes of Agriculture, considers crones as an unprofitable sort of stock, when turnips are the principal spring-food, as they cannot break turnips well.

CROOK, a provincial term applied to a hook, as a *yat-crook* or gate-hook.

Crooks, a provincial word applied to a sort of pack-horse furniture, used in Devonshire. It is observed by Mr. Marshall, that this sort of furniture varies with the nature of the load.

"Hay, corn, straw, faggots, and other comparatively light articles of burden, are loaded between 'crooks,' formed of willow poles, about the thickness of scythe-handles, and seven or eight feet long, bent as ox-bows, but with one end much longer than the other. These are joined in pairs, with slight cross-bars, eighteen inches to two feet long; and each horse is furnished with two pair of these crooks, slung together, so as that the shorter and stronger ends shall lie easy and firmly against the pack-saddle; the longer and lighter ends rising, perhaps, fifteen or more inches above the horse's back, and standing four or five feet from each other. Within, and between, these crooks, the load is piled, and bound fast together, with that simplicity and dispatch, which long practice seldom fails of striking out.

"Cord-wood, large stones, and other heavy articles, are carried between 'short crooks,' made of four natural bends or knees, boths ends being nearly of the same length; and, in use, the points standing nearly level with the ridge of the pack-saddle.

"Dung, sand, materials of buildings, roads, &c. are carried in 'pots,' or strong coarse panniers, slung together, like the crooks, and, as panniers, are usually slung; the dung, especially if long and light, being ridged up over the saddle.

"The bottom of each pot is a falling door, on a strong and simple construction. The place of delivery being reached, the trap is unlatched, and the load released."

CROOM, a provincial term applied to an implement with crooked or hooked prongs. There are muck-crooms, turnip-crooms, &c. It is sometimes written *Crome*.

CROP, the produce or quantity of corn, roots, or grass, &c. grown on a piece of land at one time; hence we have corn, root, and green crops.

Course of Crops. See *Rotation of Crops.*

CROPPING, the business of putting crops into the ground.

Cropping, in *horsemanship*, an operation performed with a pair of sheers, on the ears of horses, dogs, or other animals. Mr. John Lawrence says, "he has cropped yearlings. And that, in that time, or, at any rate, at two years old," it will be known, "whether from the over-size, ill-shape, or position of the ears, it will be ever necessary to crop the nag or not; and, if so, there is an obvious convenience in having it done early, and before he comes into work; and he has never found that the after-growth of the ear spoiled the crop. There is one disadvantage in this business, which, however, some people may think an advantage:—It furnishes an opportunity of deception." The practice of cropping the ears of animals, as it is confessedly useless, if not pernicious, as it must occasion some imperfection in the conveyance of sound to the internal ear, should be avoided as much as possible.

CROSS-*Furrow*, a term applied to the grip or furrow, which receives the superfluous rain-water from the outer furrows, and conveys it from the land into a ditch or other outlet. See *Furrow.*

Cross-*Furrowing*, the operation of making these cross-furrows or grips, which is sometimes performed by the spade, and sometimes by the plough, which should be contrived for the purpose.

Cross-*Tining*, a method of harrowing land, consisting in drawing the harrow up the interval it went down before, and down that which it was drawn up.

CROTCH, a term sometimes applied to a hook.

CROUP *of a Horse*, in *horsemanship*, the extremity of the reins above the hips. The croup of a horse should be large and round, so that the tops of the two haunch-bones be not within view of each other; the greater distance between these two bones the better: but yet it is an imperfection if they be too high, which is called *horn-hipped*; though that blemish will in a great measure disappear, if he can

be made fat and lusty. The croup should have its compass from the haunch-bone to the very onset of the tail, or extent of it.

There is a *rocking*-croup, which is when a horse's fore-quarters go right, but his croup, in walking, swings from side to side: when such a horse trots, one of his haunch-bones will fall, and the other rise, like the beam of a balance, which is a sign that he is not very vigorous or strong.

CROW. See *Rook*.

Crow, an iron bar, with a claw at one end, used as a lever, and for making holes in the ground, &c.

Crow-*Bar*, a provincial word used to signify an iron crow, or lever.

Crow-*Foot*, the name of a perennial weed, common in pastures. The leaves are divided almost to the middle, usually into seven parts. The stalk commonly divides into two branches, and each of these into two more. From the corner of each division comes a flower-stalk, supporting two large blue flowers; consisting of five roundish entire petals, succeeded by a long seed-vessel, resembling a crane's bill. This bill-like seed-vessel is thick and rough, but not so long as in some other plants. It is frequently called *Crane's Bill.*

Crow-*Net*, an invention for catching wild-fowl in the winter-season, and may be used in the daytime. This net is made of double thread, or fine packthread; the meshes should be two inches wide, the length about ten yards, and the depth three; it must be verged on the side with good strong cord, and stretched out very stiff, on long poles prepared for that purpose. When you come to the place where you would spread the net, open it, and lay it out at its full length and breadth; then fasten the lower end of the net all along the ground, so as only to move it up and down; the upper end of the net must stand extended on the long cord; the further end being first staked or tied to the earth by a strong cord, about five yards distant from the net. Place this cord in an even line with the lower edge of the net. The other end must be at least twenty-five yards distant, to reach into some natural or artificial shelter, by the means of which you may lie concealed from the fowl, otherwise no good success can be expected. The net must be placed in such exact order, that it may give way to play on the fowl on the least pull of the cord, which must be done smartly, lest the fowl should prove too quick for you. This net may also be used for pigeons, crows, or other birds, on corn-fields newly sown; as also in stubble-fields, provided the stubble conceals the net from the birds.

CROWD, a provincial word sometimes applied to wheeling in a barrow.

CROWDING-*Barrow*, a provincial word applied to a wheel-barrow.

CROWN-*Lands*, such waste-lands as are held under the crown. It is observed, in a Treatise on Modern Agriculture, that these lands are neither in that improved state into which they are capable of being put, nor productive to that degree which they might be rendered, were they in possession of private individuals. He conceives their situation to be such, unless they can, by some means or other, be improved, that it would be of no material bad consequences, in regard to supplying the public markets with provisions, if they did not exist at all. The circumstance of such extensive tracts of improvable land remaining annexed to the crown, under any change of management that may, while they remain so annexed, be adopted, will, he thinks, always operate as an insurmountable obstacle to the improvement of them; but if they were lotted off and sold, it would, he supposes, give a spring to the agriculture of the different districts where such lands are situated; and not only insure the speedy and complete improvement of them, but also of those in the neighbourhood, which are at present allowed to remain in a like waste and neglected state. See *Waste Lands*.

Crown-*Scab*, in *farriery*, a disease in horses, consisting of an eruption that breaks out round the coronet, of a very sharp and itching nature, attended with scurfiness. Solutions prepared with vitriol are generally used for the cure; but the safest way is, first to mix equal parts of marsh-mallow ointment and yellow basilicon together, spreading the composition on tow, and laying it all round the coronet. A dose or two of calomel may likewise be necessary.

CROWNED, in *horsemanship*, is when a horse, by a fall or any other accident, is so hurt or wounded in the knee, that the hair sheds and falls off, without growing again on the part.

CRUPPER, a term applied to the rump of a horse; also to a roll of leather put under a horse's tail, and drawn up by a strap to the buckle behind the saddle, so as to keep him from casting the saddle forwards upon his neck.

CUB, a provincial word applied to a cattle-crib.

CUCKOW-*Flower*. See *Lady's Smock*.

Cuckow-*Lambs*, a name applied, in some districts, to such lambs as are yeaned in April or May, because they fall in cuckow-time. They are generally either the lambs of very young or very old ewes, occasioned by their taking ram late in the season. These lambs are usually of the smallest sort, and, therefore, both ewe and lamb should have the best keep, in order to fatten the lamb for the butcher; as such diminutive lambs are improper to be kept for store-sheep.

Cuckow-*Spit*, a term applied to a kind of frothy substance, frequently found on plants, containing one or two insects. As soon as an insect of this kind comes out of its egg, it hastens to some plant, which it touches with its fundament, and fastens there a drop of white liquor, full of air: it drops a second near the first, then a third, and so on, till it covers itself all over with scum, or froth; this froth defends it from the heat of the sun, and also from the attacks of the spiders, which would otherwise devour it. Mr. Lisle is, however, of opinion, that this froth is nothing more than the nightly dew which falls upon the fork or joint of the plant, and which the little insect, with its proboscis, as with a pair of bellows, works into froth.

CUD, in *cattle*, the meat in the first stomach, which is to be chewed over again, and passed into the second, to be digested. Lost cud has been considered, by some, as a disease. It is observed by Downing, that when the stomach of a beast is too much relaxed, or too much loaded with bile, it becomes thin and emaciated, appearing very ill, and throwing up its food as soon as it has eaten, with much soapy slime.

In this case he advises the following:

Take of verjuice, one pint; oil of vitriol, half an ounce:

Mix them together, and let a hornful be given two, three, or four times in the day, till the food remains on the stomach, and then the following medicine may be given:

Take of gentian in powder, two ounces; grains of Paradise, one ounce; rhubarb in powder, half an ounce; aniseed powder, two ounces:

Mix, and let them be given in a quart of warm ale, being repeated as there may be occasion.

CULM, among botanists, signifies straw or haulm; defined by Linnæus to be the proper trunk of the grasses, which elevates the leaves, flower, and fruit. This sort of trunk is tubular or hollow, and has frequently knots or joints, distributed at proper distances through its whole length. The leaves are long, sleek, and placed either near the roots in great numbers, or proceed singly from the different joints of the stalk, which they embrace at the base, like a sheath or glove. The haulm is commonly garnished with leaves; sometimes, however, it is naked; that is, devoid of leaves, as in a few species of cypress-grass. Most grasses have a round cylindrical stalk; in some species of schœnus, scirpus, cypress-grass, and others, it is triangular. The stalk is sometimes entire, that is, has no branches; sometimes branching, as in *schœnus aculeatus et capensis*; and not seldom consists of a number of scales, which lie over each other like tiles. Lastly, in a few grasses, the stalk is not interrupted with joints, as in the greater part. The space contained betwixt every two knots or joints, is termed, by botanists, *internodum*, and *articulus culmi.* This species of trunk often affords certain marks of distinction, in discriminating the species. Thus, in some genera, the species are scarce to be distinguished but by the angles of the culmus or stalks. These, in some species, are to the number of five, in others six, and in others ten.

CULMIFEROUS-*Plants*, such as have a smooth jointed stalk, and their seeds enveloped in chaffy husks.

CULTIVATION, the art of tilling and improving soils, by manual labour, manure, or other means, so as to render the produce more early and abundant.

CULTIVATOR, a name given to implements of the horse-hoe kind, invented for stirring the earth. See *Horse-hoe.*

Implemen s of this kind are constructed in different ways, according to circumstances, and the particular uses for which they are designed. There is one made upon a simple plan, and recommended by the writer of the Agricultural Survey of the County of Nottingham. The dimensions of which, in the length of the first bull, are 4 feet 6 inches; and that of the second bull, 3 feet 9 inches. The breadth of the bull 16 inches; the teeth 2 feet long, and bent near the bottom, for the share part to lie flat on the earth, standing one foot from each other. The length of the beam is 6 feet; and the length of the iron axle-tree for the small wheels is 1 foot 6 inches. The length of the iron that shifts through the beam, and fastens with a screw, is 2 feet. There is a representation of it in the work mentioned above.

In this tool, the teeth are so placed as to intersect each other; and, as they are but twelve inches from each other by this intersecting, the distance is reduced to six inches, and the breadth of the shares being full three inches, reduces the intermediate space to so small a dimension, that the whole of the ground is entirely broken up, and answers the purpose not only of ploughing, but harrowing likewise, without cutting the quick-grass roots in two; which is an advantage that ploughing has not. From the standing forward, and bending of the teeth, it likewise brings all the roots up to the top of the land; which is another advantage that cannot be had from the plough. The reduction of labour is another advantage that belongs to this instrument, as four horses and one man will do from six to seven acres per day, in sandy land.

An implement of this sort has been invented by Mr. Cook, which consists of a diagonal beam, in which are placed a great number of narrow shares, which, when wrought in that way, is often termed a tillage *scarifier*; and when employed with broad triangular shares, it has the title of *scuffler*; and when the whole is complete, it has the name of cultivator. See *Scarifier.*

CULTOR, the strong sharpened bar of iron that is fixed in ploughs, for the purpose of cutting open the earth before the share. It is sometimes written *Coulter*. See *Plough.*

CULTURE, the art of cultivating, improving, or meliorating the soil, either by tillage or other means.

Row-Culture, that mode of cultivation in which the crop is sown or set in rows, or drills. See *Drill-Husbandry.*

CULVER, a provincial term applied to a pigeon, in some places.

Culver-*House*, a word provincially signifying a pigeon-house or dove-cot.

CURB, in *horsemanship*, a chain of iron made fast to the upper part of the branches of the bridle, in a hole called the eye, and running over the beard of the horse. The curb of a horse's bridle consists of the following parts: 1. the hook fixed to the eye of the branch; 2. the chain of SS, or links; 3. the two rings or mails. Large curbs, provided they are round, are always the most gentle. But care must be taken that it rests in its proper place,

a little above the beard, otherwise the bit-mouth will not have the effect that may be expected from it.

Curb, in *farriery*, a tumor situated on the back part of the hinder leg of a horse, immediately below the hock. According to Mr. Denny, it is generally occasioned by long-continued exertions, or local injury. The degree of lameness is in proportion to the extent of inflammation, which seldom subsides without assistance. The cure, in all recent cases, is effected by blistering; but, in obstinate cases, recourse must probably be had to the actual cautery. See *Cautery*.

CURD, the coagulum of milk, from which cheese is made. See *Cheese*.

Curd-*Mill*, a kind of mill contrived for the purpose of reducing and breaking down the curd in making cheese. It consists of two rollers, about six inches diameter, and fifteen inches long, one above the other, in a thin deep chest, as in the common cyder-mill of the southern districts. The upper roller is studded with iron spikes, an inch long, and an inch and half asunder; while the lower one is closely beset with bevil-headed nails, rising with a sharp angle, about a tenth of an inch out of the surface of the roller. The curd, after being partially broken, is put into a hopper, the bottom of which is formed by the upper roller, which, by working against the side of the box, prepares the curd for the lower roller, which, being finer and working closer, reduces it to small granules. The rollers are turned by a crank placed on one end of the axle of the upper one; the opposite ends of them having each a wooden toothed wheel, which work in each other, by which the lower one is turned.

This sort of machine must be highly useful in large cheese-dairies, where the breaking of the curd by the hand is a business of vast labour, and which requires much time. It is principally employed in the final breaking down of the curd.

CURDLING, the operation of coagulating or forming curd from milk.

CURL, a disease frequent in potatoe-crops, in which the leaves are curled and shrunk, or shrivelled up. It is remarked, in a paper in the second volume of Communications to the Board of Agriculture, that it has generally been considered "as a specific disease, arising solely from contagion, without which it is supposed that it cannot be produced, and that this contagion necessarily propagates the disease in all crops with which it is allowed to come in contact. This opinion, it is observed, appears to be ill founded. For that the curl does not necessarily propagate itself, is obvious, both from observation and experiment. We often perceive in fields of potatoes, the most healthy plants surrounded with those that are curled, and that they not only continue in a state of health and vigour while the crop remains upon the ground, but even to be afterwards mixed with them for a great length of time, without being contaminated. It is also known, that healthy potatoes are produced, not only from such as have been thus mixed with those that were curled, but experiment shows, as will hereafter appear, that they may be even obtained from curled potatoes themselves. Every farmer also knows, that the curl often takes place where no contagion was communicated, nothing being more frequent than abundance of curled potatoes from roots chosen with the greatest care, and from fields, as well as from districts, in which the curl had never been perceived. A farmer, whose potatoes, for two or three years, had been much injured with curl, judging that it happened from infected seed, procured a large supply, both for himself and some of his friends, from a district on the river Tweed, where the curl, at that time, had never been observed; but it so happened, that while some of the crops from these potatoes were entirely free of curl, others, and particularly those planted by the farmer himself, were more hurt by it than they had ever been before; which should not have been the case, if the common opinion upon this point was well founded, that curl proceeds from disease in the original set or root. We have, therefore, to search for other causes of curl; and all who notice it will find, that whatever renders a crop poor and weakly, is most apt to produce it; and that the curl, in a great measure, or perhaps entirely, proceeds from this cause. The weakly state of crop that gives rise to curl, may, it is supposed, take place from various causes, but the following appear to be the most frequent:

"1. In this district, the most frequent cause of it perhaps is, the planting potatoes on ground altogether unfit for them. Potatoes require a light, pervious, or open mould, their germs not being of a nature that can penetrate a stiff soil. This, for a great length of time after potatoes first appeared in this country, met with such marked attention, that they were never planted but in the lightest spots upon the farm, and with such care, that the plough was never employed for them: they were planted entirely with the spade, by which the soil was completely broken. Hence they had vigorous plants, and rarely any appearance of curl. But on farmers wishing to extend the culture of potatoes, and being induced thereby to plant them on every variety of soil, as they now frequently do, the crops became weak, and the curl frequent. In the culture of every other crop, farmers take care to appropriate particular soils to each; for they know that they commonly fail, if this necessary piece of attention be overlooked. Those who have light sand only, do not sow beans; while, on stiff clay soils, the culture of turnips is never attempted. In like manner, potatoes require a peculiarity of soil, and in so far as this is deviated from, the crop is commonly weak, and liable to curl. In a field of several acres, which every fourth year was planted with potatoes, about half an acre, or thereabouts," he says, "was stiff clay, while the rest was a free dark-coloured loam, rather tending to sand than clay. On all this part of the field, the crop was uniformly strong, and free of curl; while on the half acre of clay, although manured with the same quantity of dung, planted with the same seed, and in every cir-

cumstance managed in the same manner, the plants were all weak, and a great proportion of the whole curled.

" 2. But imperfect culture is, perhaps, the most frequent cause of curl. This will be found to hold with such uniformity, that a crop of potatoes is commonly strong, abundant, and free of curl, in proportion to the previous culture given to the soil, and care taken to keep it clean after they are planted. This, indeed, is so remarkably the case, that, excepting in very kindly soils, the additional produce from trenching and planting with the spade, is commonly more than sufficient to repay all the difference of expense between this mode of culture and that of planting with the plough. On a large scale, indeed, the spade cannot be employed, and plentiful crops are, no doubt, often obtained with the plough; but many are not sufficiently aware of the full necessity of ploughing and cleaning their grounds well before the crop is planted; for if the mould is not previously well broken, it cannot be done afterwards, so that the plants are weak from their first appearance, and a great proportion of the whole curled. The effect of complete previous tillage, in the culture of potatoes, is, indeed, so remarkable, that there is reason to believe, that the amount of our potatoe-crop, in a great proportion of cases, would be more than double of what it commonly is, if the ground on which they are planted was previously put in better order. Of this, many proofs might be given, but the writer only mentions two: a farmer, who every year planted several acres of potatoes with the plough, allowed his cotters and servants to plant nearly two acres for their own use; but these last being commonly on spots of difficult access, could not easily be managed with the plough, and, being always in bad order, they were planted with the spade, in the form of what is usually termed lazy beds: the effect of this uniformly was, that although the crops, even of those planted with the plough, were always good, being sometimes at the rate of three hundred Winchester bushels on the Scotch acre, and weighing from eight to ten tons; the others, in different instances, weighed more than the double of this, and for the most part were entirely free of curl. And the writer soon after getting possession of a farm, being late in overtaking his potatoe-crop, a considerable part of a field, which happened to be both full of root-weeds, and not sufficiently broken, was in that situation planted by his servants before he knew of it; but half an acre, or thereabouts, being still worse than the rest, it was kept either with a view to give it a complete fallow, or to sow it with tares. The season, however, being dry, which favoured the cleaning of ground, this piece was three times ploughed, well harrowed after each ploughing, and the root-weeds gathered and carried off. Being now in fine order, it received the same quantity of dung which was given to the rest; it was planted with potatoes taken from the same quantity, and in every other circumstance managed in the same manner; but the event was widely different. Although a week later in planting, the crop was sooner above the surface; the plants were stronger from their first appearance, and scarcely a curled stem to be met with; while, in every row of the others, the curl was frequent. The ground was kept clean with less than a fourth part of the expense and trouble; the produce was more than double; the ensuing crop of wheat was considerably better on this piece, and the ground continued in every respect in better condition, till the third crop, when more pains was taken with the rest of the field.

" 3. He has reason, from experiment, to think, that small roots, or too small a portion of strong roots, being given to each set, has an influence in producing a weak crop, and curled plants. It is, perhaps, equally necessary in the culture of potatoes, as in that of wheat or any other crop, to make a choice of healthy full-grown seed; but this is not always done: small potatoes are often, indeed, purposely kept for planting, instead of those that are full-grown, and therefore more capable, he supposes, of producing a vigorous progeny. In like manner there is cause to suspect, he says, that our frequent attempts, of late years, to discover new varieties of potatoes, by raising them from seed instead of the root, have had some influence in rendering the curl more frequent; plants raised from the seed being commonly, for the first two or three years, very weak and feeble. Sixty-four sets were planted; sixteen of which were full-grown potatoes; sixteen from small roots in which no curl appeared when in the field; sixteen from roots raised from the seeds two years before; and sixteen from roots of plants strongly curled. They were all planted in the same manner, in a light soil, and in furrows parallel to each other, with a moderate quantity of dung to each, and covered to the depth of three inches. Of those taken from large potatoes, none were curled, and the plants were all strong and healthy. Some good plants appeared in each of the other rows, but nearly a half of the whole were curled. The proportion of curled plants was greatest in those lately raised from the seed: in the other two rows they were nearly the same. The row planted with curled potatoes had seven curled plants, and the other only six; but in this last row, the other three were so weak from the first, that, although not obviously curled, they soon began to shrivel, and in the course of two or three weeks disappeared entirely.

" 4. It has, he says, been mentioned by a noted planter of potatoes, that sets taken from roots that have sprouted early, and from which the germs have been rubbed, as is commonly done, with a view to the preservation of the sets, never fail to produce curl. The plants which succeed to the second production of germs, are always, he observes, very weak, and with such certainty produce curl, that he is induced to consider this as the only cause of it; but this attentive observer will find, that whatever tends to render a crop, or even particular plants in a crop, weak and delicate, will, in like manner, seldom fail to produce curl.

" 5. Too much, as well as too little, dung, ap-

pears, he says, to have influence in producing curl; the first may probably act, by corrupting the germ of the young plant; the latter, by not being sufficient to produce vigorous plants. This effect, resulting from an unequal application of dung, may, perhaps, be considered as the most frequent cause of that partial appearance of the curl, that we often meet with in fields managed all, apparently, in the same manner; for dung is often spread in such a careless slovenly manner, that, while some of the plants have none, others have it in too great a proportion, being sometimes covered with it to the depth of several inches.

"6. Too deep as well as too shallow planting, he thinks, are both apt to produce the curl, but the first of these errors is perhaps the most frequent. The sets should never be placed deeper at first than three inches, however useful it may afterwards prove to lay the earth up to the stems; but instead of this, by the usual method of planting in drills, or ribs as they are termed, and throwing two deep furrows over the plants, they are frequently covered to the depth of nine or ten inches; by which, from a total exclusion of air, and perhaps from other causes, the crop is always late in piercing the surface, and many of the plants are weak and curled. These ridges are indeed commonly harrowed down at last, but often not till it is too late. And where the plants are placed too near the surface, if the ground itself is dry, they rise in weak feeble stems, and many are curled for want of moisture alone. With a view to ascertain the best depth for sets of potatoes, twelve were planted at eighteen inches deep, the same number at the depth of sixteen inches, fourteen, twelve, ten, eight, seven, six, five, four, three, and two inches; and twelve were so lightly covered, that they were not perhaps at the depth of one inch. The sets were all from large roots of the same crop, and all as nearly as possible cut of the same size; they were all planted at the same time, in the first week of April, in a light dry soil, and they all got the same quantity of dung, and in every other circumstance were managed in the same manner. The plants at the depth of one, and two inches, appeared first, but they were weak, and some of them curled. Those at three, four, and five inches were all strong, healthy, and entirely free of curl. At six and seven inches they were also healthy and free of curl; but they were three weeks later in getting above the ground than those that were thinly covered, and the plants neither so strong, nor the roots so large. Those planted at the depth of eight inches were still later in piercing the surface; they were all weak, and nine out of the twelve were curled. Only four ever appeared of those planted ten inches deep, and they were so weak that they very soon withered and died. Of those placed at the depth of twelve, fourteen, sixteen, and eighteen inches, none ever appeared; and on digging them up at the end of two months, those at sixteen and eighteen inches deep were found just in the state in which they were planted, without any appearance of vegetation on any part of them; while some of those at the depth of twelve and fourteen inches had put forth some feeble germs, none of them exceeding the length of an inch. Those planted at the depth of three and four inches were evidently the strongest plants during the whole season, and their roots largest. Those at five inches deep were nearly equally good, but they were ten days later in appearing above the surface, and the stems never became so strong, nor the roots so large, as the others not so deeply covered. He is therefore convinced, from the result of this, as well as other experiments on the same subject, that about three inches is the best depth at which potatoes can be planted; that the crop will be more or less early, abundant, and, in general, more or less injured with curl, according as the roots are placed at a greater or less depth than this. The result even of the same experiment upon this point may indeed be different in different soils and seasons, but he has much reason to think that in general it will be nearly the same.

"7. Whatever injures the new planted sets, or the germs afterwards, may produce curl; such as the sets being trampled upon and broken by the horses' feet, in the time of planting; particular sets being partially covered with stones or impenetrable clods of earth; severe and deep harrowing, when the young shoots are advancing; and grubs, snails, and other insects, destroying the germs at first, or the stems afterwards.

"8. Some years ago, when on a journey, he observed a field with a greater proportion of curled potatoes than he had ever before seen, by which he was induced to inquire into the culture of the crop. The ground he found was stiff, and not having been sufficiently broken before the crop was planted, the farmer had passed a roller over it about a fortnight after planting; the effect of which was, that many of the plants did not appear at all, and a very uncommon proportion of those that came forward were curled. This might in part be owing to the state and nature of the soil: but in a great measure it seemed to depend upon the solidity given to it by the roller; for in the contiguous field, where the soil was exactly similar, the plants were more vigorous, and the curl not so frequent.

"9. The state of the weather, while the crop is young, has an obvious effect in rendering the curl more or less frequent. It does not appear that rain, in whatever quantity it may fall, has any effect, if it be not allowed to lodge, and if the soil is such as potatoes ought to be planted in, that is, a light pervious loam, with little or no tendency to clay. But we frequently find that a long continuance of dry weather when the shoots first come forth, particularly when accompanied with severe cold winds, is very apt to produce curl. In this early state of the crop, too, frost seldom fails to produce it, particularly hoar frost. This should lead farmers, he thinks, to fix on that season for planting, in which they find from experience that their district of country is least liable to be injured by these causes, and chiefly by cold winds, frost, and a long continuance

of dry weather. So far as the writer has observed, the first, second, or third weeks of April answer best for the south of Scotland, and north of England. Potatoes planted at this period do not appear till the middle or end of May; after which, if it be not in low fields, contiguous to rivers or marshy grounds, in which hoar frosts are frequent, they seldom suffer from frost, at the same time that dry weather does not hurt them so much as it commonly does, when they do not appear till the middle of June, when, the heat and evaporation being more considerable, any scarcity of rain proves more particularly hurtful to all such plants as require a full supply of moisture, and which certainly is the case with potatoes, while the plants are young, and do not cover the ground. For although good potatoes cannot be raised on soils naturally wet, every farmer may observe, that nothing tends with more certainty to prevent curl, and produce vigorous perfect roots, than frequent showers in the early state of the crop. As a proof of the influence of winds on crops of potatoes, and in the production of curl, may be mentioned, what the writer of this has several times observed, that in the district of country in which he resides, where easterly winds commonly prevail during the months of April, May, and June, all such fields as are sheltered from this wind by high walls and hedges, do not so readily produce curled potatoes as others commonly do. In two instances in his own fields it has happened, that the plants on those ridges immediately west of a stone-wall have been strong, and entirely free of curl, while the rest of the crop was poor, with several curled plants in every ridge, although the seed and culture were the same over the whole. The general result of all these observations is, therefore, that the curl is not a disease, but only an accidental debility of those plants in which it occurs. We are not, he thinks, therefore, to seek for a cure, or preventative, in a change of seed alone, as many have all along done, but in complete attention to all that experience shows to be necessary for an accurate culture of the crop: from which alone there is much reason to think, that this very useful article of life may be cultivated with the same success as before this dreadful enemy the curl made such havock in our crops. By proper attention to these observations it is probable that this troublesome disease may in a great measure be removed."

Much is still wanting on this subject, to render its nature and causes obvious. Great advantage would arise from a series of comparative trials carefully made with the seed of diseased and healthy potatoes

CURRY-COMB, an iron implement full of small teeth, used for currying horses.

CURRYING, in *horsemanship*, the operation of combing or dressing horses by means of a curry-comb.

CURTAIL, in *farriery*, a name given to the tail of the horse after he has undergone the operation of docking, or having a part of his tail taken off. See *Docking*.

CUSPATED *Flowers*, those whose petals or flower-leaves end in a sharp point.

CUSTOMARY-*Lands*, such lands as are granted by lords of manors to their tenants. Mr. Donaldson observes, that "a considerable portion of the lands of England is held under lords of manors by copyhold or customary tenure, subject to the payment of fines on the alienation of the property, the death of the lord or of the tenant, and also to the payment of certain yearly rents, and the performance of various services. That this sort of tenure, says he, should be considered not only as a grievance, but also as an obstacle to agricultural improvement, cannot appear surprising, when it is remarked that the lord of the manor is entitled to two years improved value of the copyholds on the death of the copyhold tenant, or on the alienation of the property. Under such circumstances, it is not probable that the possessors will be disposed to a liberal expenditure of money on the improvement of lands held by a tenure of this restricted kind. Besides, says he, the services performable by the proprietors of copyhold lands in the north west of England in particular, are disgraceful in the extreme, and such as, in a free country, ought to be for ever abolished. They consist of cutting, drying, and leading the lord's peats, ploughing and harrowing his land, reaping his corn, making his hay, carrying his letters, &c. whenever and how often soever such services are demanded. It could not, he supposes, be a matter of much difficulty to arrange general terms, on which copyholders might have it in their power to enfranchise their estates, by payment of a certain sum to the lords of manors for the total abolition of this remain of the feudal system. So far as he is informed, lords of manors may, as the law now stands, make any arbitrary demand they please on their vassals for the enfranchisement of their lands; and if not complied with, they must remain in the state above described. Whereas, were an equitable mode established, whereby the copyholder could purchase his independence on reasonable terms, few would continue in a state of bondage, nor would the improvement of the country be obstructed by the arbitrary exactions of the superiors and great landholders. As manorial rights have been handed down from father to son for many generations; and as by the law of the country the present possessors have as good a title to exercise these rights as any of their predecessors: it would, he says, be unjust to deprive them of that privilege, without giving them an equitable compensation: but when the exercise of these rights stands in the way of improving the national territory, and of supplying the public markets with provisions, it must be deemed impolitic in the legislature to permit them to exist. It is very generally known, he says, that one great obstacle to improvement arises from a laudable anxiety in the customary tenants to have their little patrimony descend to their children. These small properties (loaded with fines, heriots, and boondays, joined to the necessary expense of bringing up and educating a numerous family) can

only be handed down from father to son by the utmost thrift, hard labour, and penurious living; and every little saving being hoarded up for the payment of the eventful fine, leaves nothing for the expense of travelling to see improved modes of culture; to gain a knowledge of the management and profits of different breeds of stock; and to be convinced, by ocular proofs, that their own situations are capable of producing similar advantages: and even should they be half inclined to adopt a new practice, prudence whispers, that should the experiment fail, it would require the savings of many years to make good the deficiency. Customary tenures are therefore allowed on all hands to be a great grievance and check to improvement. This, he thinks, might be done away on the division of common rights. The yearly value of the various customs, fines, &c. might be settled by commissioners, and twenty-five, or any reasonable number of years purchase on this yearly value, be the price of the enfranchisement, which might be paid in money, or in land, at the option of the copyhold tenant. It is impossible, says he, any solid argument can be urged against the propriety of abolishing, without delay, every remain of the feudal system, where it tends, in the smallest degree, to obstruct the general improvement of the country. This may be accomplished with very little trouble. All that appears necessary, in regard to copyhold lands, for instance, is, either to adopt the plan above-mentioned, or to pass one general act of parliament, empowering those who hold their estates only mediately of the crown, but immediately of a subject superior, to demand of that superior, that, by means of legal proof, he shall ascertain the actual yearly value in money or grain of the fines payable on the alienation of the property, the death of the superior, or lord, or of the copyholder. Where personal services are payable, as casting peats, carrying letters, &c. the value of these should also be ascertained, and the proprietors, so situated, have it in their power to become independent, by paying a reasonable number of years purchase, or by making payment annually of the sum thus ascertained to be the value of these fines and services. Were such an arrangement to be made, copyholders would, says he, have an inducement to cultivate their lands in the best possible manner; because they, not the superiors, would reap the profits arising from improved cultivation."

CUT, in *farriery*, a hurt with any sharp instrument; or a clean wound made with a sharp-cutting instrument. The rational way of treating such an accident, in all cases, is to bring the two incised surfaces together, and bind them up, if possible, with a little lint or tow laid on superficially, without any balsams or spirituous applications being used. The first dressings of the wound not being taken off for some days, at least not before there are some appearances of discharge from it. In some cases where this method is practised, the *union by the first intention* will prove so complete as not to require a second dressing, even though the cut be deep and of considerable extent.

CUTTING, in *horsemanship*, is when a horse with the shoe of one foot beats off the skin from the pastern joint of the other hoof. This, Mr. White says, is frequently occasioned by the horse's turning his toes outward. In such cases, it is prevented by thickening the inner heel or branch of the shoe, by which this improper direction of the foot is altered; but whenever this accident happens, it is very necessary to ascertain what part of the hoof or shoe it is that inflicts the wound, as that will sometimes point out to us the means of preventing it. The speedy cut is frequently caused by an inward inclination of the toes; in such cases it is proper to thicken or raise the outer heel of the shoe. When a horse cuts with one foot only, the shoe of that foot which receives the injury is to be altered, and that part of the hoof which cuts to be rasped, or otherwise altered.

CUTTING-*Box*, a machine for cutting different substances, as straw, hay, or the stems of any kind of plants, into small pieces, what is commonly called chaff, for the use of cattle.

In *pl.* XVII. *fig.* 4. is a representation of an improved cutting-box. The improvement consists in what the inventor calls a presser, which is a piece of wood as long as the box is wide, with three iron tongues in it, like those of a hay-fork. These tongues are put into the bundle of hay or straw to be cut, and by means of a rope fixed thereto, and extending under the box, the presser is forced down by the left foot of the cutter, and consequently the bundle kept tight. By this means the chaff is cut with great ease; and, after every cut, the operator raises his left foot, pushes his sheaf or bundle forward with his left hand, then presses it down again with his foot, and takes another cut. In this manner he continues working, till the whole bundle is reduced to chaff. This description will be better understood by inspecting the figure referred to above, where *a* is the presser, *b* a large knot at the end of the rope, which fastens it to the presser, *c* the rope, *d* the slit in which the rope moves, as the cutter pushes the bundle forward. *e* the loop, in which the cutter puts his left-foot. *f* the box to contain the hay, straw, &c. The knife is not delineated in this figure, as the manner of placing it is sufficiently evident.

In the Rural Economy of the Midland Counties, Mr. Marshall observes, that chaff-cutting, as it is pretty generally termed, but here provincially "straw-cutting," is in great use. Not, however, the ordinary practice of cutting hay and straw into what is, in most places, called chaff or cut chaff, but, here, more properly "cut meat;" but by reducing oats, in straw, into this species of fodder; which is given, not to horses only, but to cattle, especially fattening cattle. It is thought to give, not only fatness, but a fineness of skin, to all sorts of stock.

"The chaff-box made use of, he says, is of a peculiar construction. It unites, in some measure, the old single-hand machine, and the modern one with a wheel of blades. It has a long upright knife, but feeds itself; by which means the cutter has both

hands at liberty for the knife. It is, however, somewhat complex; and fitter for a man who makes a business of "straw-cutting," than for a farmer's servant.

"The price of cutting, three farthings a heaped bushel; but it is cut extraordinarily fine."

CYDER, a liquor made from the expressed juice of apples by means of fermentation.

There are a great variety of apples cultivated in the different cyder districts for the purpose of being converted into that liquor; but all such as have a yellow or light-red ground, tinged with red streaks on the sun side; a smart acid flavour; with firm and juicy parenchyma, and are of an aromatic flavour, by whatever name they may be called, will unquestionably make good cyder. But it has been remarked by Mr. Knight, that the properties which constitute a good apple for cyder and the desert, are seldom found in the same fruit. The firmness of pulp, which is essential in an eating-apple, is useless, he says, in the cyder-fruit; and colour, which is disregarded in the former, is amongst the first qualities of the latter: some degree of astringency, which is injurious to the eating-fruit, is likewise, he conceives, advantageous to the other. See *Apple*.

In gathering the apples for this liquor, care should be taken that they be thoroughly ripe before they are taken from the tree; otherwise the cyder will be of a rough, harsh taste, in spite of all the endeavours of the operator. It is observed by Mr. Crocker in his tract on the Art of Making and Managing Cyder, that the most certain indications of the ripeness of apples is the fragrance of their smell, and their spontaneously dropping from the trees. When they are in this state of maturity, in a dry day, the limbs may, he says, be slightly shaken, and partly disburthened of their golden store; thus taking such apples only as are ripe, and leaving the unripe longer on the trees, that they may also acquire a due degree of maturity. It may not, he thinks, be amiss to make three gatherings of the crop, keeping each by itself. The latter gathering, as well as wind-falls, can however only be employed in making inferior cyder: the prime cyder must be drawn from the former gatherings.

According to the writer first mentioned, the merit of cyder will always depend much on the proper mixture, or rather on proper separation, of the fruits. Those whose rinds and pulp are tinged with green, or red without any mixture of yellow, as that colour will disappear in the first stages of fermentation, should be carefully kept apart from such as are yellow, or yellow intermixed with red. The latter kinds, which should remain on the trees till ripe enough to fall without being much shaken, are alone capable of making fine cyder. Each kind should be collected separately, as noticed above, and kept till it becomes perfectly mellow. For this purpose, in the common practice of the country, they are placed in heaps of ten inches or a foot thick, and exposed to the sun and air, and rain; not being ever covered, except in very severe frosts. The strength and flavour of the future liquor are however, he says, increased by keeping the fruit under cover some time before it is ground; but unless a situation can be afforded it, in which it is exposed to a free current of air, and where it can be spread very thin, it is apt to contract an unpleasant smell, which will much affect the cyder produced from it. Few farms are provided with proper buildings for this purpose on a large scale, and the improvement of the liquor will not nearly pay the expense of erecting them. It may reasonably be supposed, that much water is absorbed by the fruit in a rainy season; but the quantity of juice yielded by any given quantity of fruit will be found to diminish as it becomes more mellow, even in very wet weather, provided it be ground when thoroughly dry. The advantages therefore of covering the fruit will probably be much less than may at first sight be expected. No criterion appears to be known, he says, by which the most proper point of maturity in the fruit can be ascertained with accuracy; but he has good reason to believe that it improves as long as it continues to acquire a deeper shade of yellow. Each heap should be examined prior to its being ground, and any decayed or green fruit carefully taken away. The expense of this will, he observes, be very small, and will be amply repaid by the excellence of the liquor, and the ease with which too great a degree of fermentation may be prevented.

And Mr. Crocker remarks, that the cyderist who would be particularly curious in his prime liquor, should hand-gather his fruit, and keep the sorts separate one from another: but as this would be troublesome, expensive, and in a full season wholly impracticable, the general crop may, at different times, be shaken down, and collected from the ground. Fruit of equal ripeness, and whose qualities are nearly alike, should be heaped together, to meliorate their juices, or, in other words, to perfect the saccharine fermentation. How this is best done, cyder-makers are not agreed: some judging it altogether unnecessary to heap them at all, if sufficient time be allowed for perfecting the saccharine fermentation on the tree: some considering it best to sweat them in close lofts: while others allege, that the open air is the only place where they ought to be heaped. Experience, however, should, he thinks, teach us, that most apples require time for their being mellowed, to attain their highest flavour; and until this mellowing be perfected, their juices are not in the best state for being converted into cyder.

Philosophy has shown, he says, that fermentation is never improved by hastening the operation with too much heat; nor perfected in due time under too great an exposure to cold. It would be well, therefore, if apples, when gathered from the tree, were placed in open sheds, having boarded floors, in heaps or layers of ten or twelve inches deep; the hard and harsh fruits might probably be laid in heaps of greater depth, the sorts to be kept separate, as much as the conveniences of the sheds will allow: at any rate, if there must be a mixture of apples in

the same heap, let them, says he, be such as are of qualities nearly alike, and which are of equal ripeness at the time of gathering; but on no account should sweet and sour fruit be heaped together. To some cyderists it may have appeared unnecessary to keep the different sorts of apples separate; but it is of importance so to do; and the trouble is very little, as has been observed, compared to the advantages which will hereafter result from a regular fermentation of the juices. The impropriety of housing and laying apples in very large heaps must, he thinks, be manifest to every thinking mind; more especially when in the same room are found all sorts; sweet, sour, harsh, generous, ripe and unripe, thrown promiscuously together; where some are rotten before others are mellowed And what must the liquor be which is expressed from such an heterogeneous mass? But supposing that the fruit, which is of different sorts and qualities, has been kept separate from one another a few weeks; it will be perceived, that some of the prime sorts are in a proper state of maturation; that the pulp has acquired its highest degree of richness; the kernels assumed their brownest colour; the rind still free from any appearance of rottenness; and that they readily yield to the pressure of the thumb: then is the time, and such is the fruit to be employed in making prime cyder: every necessary utensil must now be set in order: the mill, press, tubs, casks, pails and bowls, clean washed, and suffered to dry before they are employed.

In grinding the apples for this use into pommage, several methods are practised; but the two most chiefly in use are, the bruising-stone with a circular trough, and the apple-mill. In the trough, the apples are thrown and bruised by the motion of the stone, as it is moved round by a horse, in the way that tanners grind bark. This is an ancient method, and still in use in some parts of Devonshire; and although it has its inconveniences, in bruising some apples too much and some too little, it is not without its advocates in those parts of the country; the inhabitants of which allege, that it bruises the kernels of the fruit better than other machines. Although it must be admitted, that the kernels possess an agreeable aromatic bitter, yet it has been held questionable, if they impart any perceivable beneficial quality to the cyder. Be this as it may, certain it is, that this method of converting apples to pommage by the trough and stone has, in the last fifty years, much given way to the apple-mill.

It is remarked by Mr. Knight, that where iron mills have been tried, this metal has been found to be soluble in the acid of apples, to which it communicates a brown colour and an unpleasant taste. No combination has, he believes, been ascertained to take place between this acid and lead; but as the calx of this metal readily dissolves in, and communicates an extremely poisonous quality to, the acetous juice of the apple, it should, he thinks, never be suffered to come into contact with the fruit or liquor.

Of these mills there are various constructions; some being worked by hand, some by horses, and others by water. See *Cyder-Mill.*

Cyderists have not agreed in opinion, whether the pommage should immediately after grinding be conveyed to the press, there to be formed into a kind of cake, or what is called the cheese; or whether it should remain some time in that state before pressing. Some say it should be pressed immediately after grinding; others conceive it best to suffer it to remain in the grinding-trough, or in vats employed for the purpose, for twenty-four hours, or even two days, that it may acquire not only a redness of colour, but also that it may form an extract with the rind and kernels. Both extremes are, Mr. Crocker thinks, wrong. There is an analogy, he says, between the making of cyder from apples, and wine from grapes; and the method which the wine-maker pursues ought to be followed by the cyder-maker. When the pulp of the grapes has lain some time in the vats, the vintager thrusts his hand into the pulp, and takes some from the middle of the mass; and when he perceives, by the smell, that the luscious sweetness is gone off, and that his nose is affected with a slight piquancy, he immediately carries it to the press, and by a light pressure expresses his prime juice. In like manner should the cyderist determine the time when his pulp should be carried to the press. If he carry it immediately from the mill to the press, he might lose some small advantage which may be expected from the rind and kernels, and his liquor may be of lower colour than he might wish. If he suffer it to remain too long unpressed, he will find, to his cost, that the acetous fermentation will come on before the vinous is perfected; especially in the early part of the cyder-making season. He will generally find that his pulp is in a fit state for pressing in about twelve or sixteen hours. If he must, of necessity, keep it in that state longer, he will find a sensible heat therein, which will engender a premature fermentation; and he must not delay turning it over, thereby to expose the middle of the mass to the influence of the atmosphere. Mr. Knight, however, thinks it should remain twenty-four hours before it is taken to the press. See *Cyder-Press.*

The pommage being now in a proper state, it is carried to the press, and a square cake or cheese made of it, by placing very clean sweet straw or reed between the various layers of pommage; or by putting the same into hair-cloths, and placing them one on another. It is of importance that the straw or reed be sweet, and perfectly free from any fustiness, lest the cyder be impregnated therewith. Particular care ought also to be taken to keep hair-cloths sweet, by frequently washing and drying; or the ill effects of their acidity will be communicated to the cyder. To this cake or cheese, after standing awhile, a slight pressure is at first to be given, which must be gradually increased, until all the must or juice is expressed; after which, this juice must be strained through a coarse hair-sieve, to keep back the gross feculencies of the juice, and be put into

proper vessels. These vessels may be either open vats or close casks; but as, in the time of a plentiful crop of apples, a number of open vats may by the cyderist be considered an incumbrance in his cyder-rooms, the must should be generally carried immediately from the press to the cask. Thus far, says Mr. Crocker, cyder-making is a mere manual operation, performed with very little skill in the operator; but here it is that the great art of making good cyder commences; nature soon begins to work a wonderful change in this foul-looking, turbid, fulsome, and unwholesome fluid; and, by the process of fermentation alone, converts it into a wholesome, vinous, salubrious, heart-cheering beverage.

Philosophy has shown, and experience justifies the position, he says, that the juices of all vegetables, when exposed to certain degrees of heat and atmospheric influence, are disposed by nature to a spontaneous intestine motion of their constituent parts: this is called fermentation.

It is observed by Mr. Knight, that the juice of the apple in its unfermented state consists of sugar, vegetable mucilage, acid, water, its tingeing matter, the principle of smell, and he believes of astringency. Of these component parts, the first only is known to be capable of producing ardent spirit, and it might thence be inferred that the strongest cyders would be afforded by the sweetest fruits: but the juice of these generally remains defective in what is termed "body" in liquors, and it is extremely apt to pass from the saccharine to the acetous state. Much of the strength of cyder is supposed by the Herefordshire farmers to be derived from the rind and kernels of the fruit, and hence arises their great attention to grind it thoroughly; the stalks also are necessarily reduced, when the apples are thoroughly ground, and he suspects that the body of the liquor is strengthened, and its flavour improved, by the astringent juice of these: yet it does not appear probable, he says, that either of these contains any saccharine matter.

It is well known that there are various stages of fermentation in the juices of all vegetables, each of which changes the very nature and quality of the fluid; but the principal ones which are to be particularly attended to, in the instance now under consideration, (the must, or juice of apples) are three; namely, the vinous, the acetous, and the putrefactive. The first converts the must from its turbid, fulsome state, to a transparent spirituous liquor, lightly piquant on the palate, resembling wine both in its flavour and effects.

It has been observed, Mr. Knight says, to take place in such bodies only as contain a considerable portion of sugar, and it is always attended with the decomposition of that substance. The liquor gradually loses its sweetness, acquires an intoxicating quality, and by distillation affords a greater or less quantity of ardent spirit, according to the quantity of sugar it originally contained, and the skill with which the process has been conducted. When this fermentation proceeds with too much rapidity, it is often confounded with the acetous, but the products of that are totally different. A violent degree of fermentation however, though purely vinous, is extremely injurious to the strength and permanence of cyder, probably owing to a part of the ardent spirit being discharged along with the disengaged air.

If the juice has been expressed from sour apples, Mr. Crocker observes that this fermentation is perfected in two or three days; but if from sweet apples, not under a week or ten days, or longer.

The next stage of fermentation gives an acidity to the vinous liquor before spoken of, converting it to a sort of vinegar. This fermentation begins soon (frequently in a few hours) after the vinous is ended, and, if the fermentation be improperly hastened by heat, before the vinous can be perfected.

Mr. Knight remarks that it usually succeeds the vinous; but that it will sometimes precede it, when the liquor is in small quantity, and exposes a large surface to the air. In this process, vital air is absorbed from the atmosphere, and the ardent spirit, vegetable acid, and sugar, if any remain, are alike converted into vinegar.

And he remarks, that in the putrefactive process, which follows the acetous, the vinegar loses its acidity, becomes foul and viscid, and emits air of an offensive smell: an earthy sediment subsides, and the remaining liquid is little but water.

Although we cannot, Mr. Crocker thinks, form any clear and distinct knowledge of the precise manner in which nature performs these changes in fermenting liquors, yet the effects are evident; and from a consideration of the different natures and results of the various fermentations, it may be perceived, that the first is the only one useful in making good cyder; and that the others tend to vitiate, and render unwholesome, a liquor that would otherwise be highly pleasant and truly salubrious. To regulate the first, and to check the others, is then, says he, the great business of that cyder-maker who would attach to himself the satisfaction and fame which every one is emulous of.

In order to attain these ends, fermentation should not, he thinks, by too much heat, be carried on rapidly, nor, by extreme cold, too slowly; as, in each case, the fermenting body must be injured. Hence it appears, that a certain degree of warmth, or rather imperceptible heat, conduces best to regulate this operation. This degree of warmth may be understood to rest between forty and fifty degrees of Fahrenheit's thermometer. If then the warmth of the cellar, in which new-made cyder is placed, be between these points (no adventitious cause intervening), we may expect that the vinous fermentation will commence and go on with due regularity.

It has been observed above, that fermentation is an intestine motion of the parts of a fermentable body. This motion, in the present case, is always accompanied with an evident ebullition; the bubbles rising to the surface, and there forming a scum, or soft and spongy crust, over the whole liquor. This crust is frequently raised and broken by the air as it

disengages itself from the liquor, and forces its way through it. This effect continues whilst the fermentation is brisk, but at last gradually ceases. The liquor now appears tolerably clear to the eye, and has a piquant vinous sharpness upon the tongue. If in this state the least hissing noise be heard in the fermenting liquor, the room is too warm; and atmospheric air must be let in at the doors and at the windows.

Now, continues he, is the critical moment which the cyderist must not lose sight of; for, if he would have a strong, generous, and pleasant liquor, all further sensible fermentation must be stopped. This is best done by racking off the pure part into open vessels, which must be placed in a more cool situation for a day or two; after which it may again be barrelled, and placed in some moderately-cool situation for the winter. The Herefordshire cyder-farmers, after the cyder has perfected its vinous fermentation, place their casks of cyder in open sheds throughout the winter; and, when the spring advances, give the last racking, and then cellar it. In racking, it is advisable that the stream from the racking-cock be small, and that the receiving-tub be but a small depth below the cock; lest, by exciting a violent motion of the parts of the liquor, another fermentation be brought up. The feculence of the cyder may be strained through a filtering-bag, and placed among the second-rate cyders; but by no means should it be returned to the prime cyder. In this situation the cyder will, in course of time, by a sort of insensible fermentation, not only drop the remainder of its gross lees, but will become transparent, highly vinous, and fragrant.

It is observed by Mr. Knight, that after the fermentation has ceased, and the liquor is become clear and bright, it should instantly be drawn off, and not suffered on any account again to mingle with its lees; for these possess much the same properties as yeast, and would inevitably bring on a second fermentation. The best criterion to judge of the proper moment to rack off will be, he says, the brightness of the liquor; and this is always attended with external marks, which serve as guides to the cyder-maker. The discharge of fixed air, which always attends the progress of fermentation, has entirely ceased; and a thick crust, formed of fragments of the reduced pulp, raised by the buoyant air it contains, is collected on the surface. The clear liquor being drawn off into another cask, the lees are put into small bags, similar to those used for jellies: through these whatever liquor the lees contain gradually filtrates, becoming perfectly bright; and it is then returned to that in the cask, in which it has the effect, in some measure, of preventing a second fermentation. It appears to have undergone a considerable change in the process of filtration. Its colour is remarkably deep, its taste harsh and flat, and it has a strong tendency to become acetous; probably by having given out fixed and absorbed vital air. Should it become acetous, which it will frequently do in forty-eight hours, it must not on any account be put into the cask. If the cyder, after being racked off, remains bright and quiet, nothing more is to be done to it till the succeeding spring; but if a scum collects on the surface, it must immediately be racked off into another cask; as this would produce bad effects if suffered to sink. If a disposition to ferment with violence again appears, it will be necessary to rack off from one cask to another, as often as a hissing noise is heard. The strength of cyder is much reduced by being frequently racked off; but this arises only from a larger portion of sugar remaining unchanged, which adds to the sweetness at the expense of the other quality. The juice of those fruits, which produce very strong cyders, often remains muddy during the whole winter, and much attention must frequently be paid to prevent an excess of fermentation.

The casks, into which the liquor is put whenever racked off, should always have been thoroughly scalded, and dried again; and each should want several gallons of being full, to expose a larger surface to the air.

But, should the cyder-maker neglect the above precautions, the inevitable consequence will be this: Another fermentation will quickly succeed, and convert the fine vinous liquor he was possessed of into a sort of vinegar; and all the art he is master of will never restore it to its former richness and purity.

When the acetous fermentation has been suffered to come on, the following attempts may be made to prevent the ill effects of it from running to their full extent. For this purpose several means have been tried, sometimes with a degree of success, at other times wholly unavailably; the most popular ones would, however, seem to be these: A bottle of French brandy; half a gallon of spirit extracted from the lees of cyder; or a pail-full of old cyder, poured into the hogshead soon after the acetous fermentation is begun: but no wonder if all these should fail, if the cyder be still continued in a close warm cellar. To give effect to either, it is necessary that the liquor be as much exposed to a cooler air as conveniently as may be, and that for a considerable length of time. By such means it is possible fermentation may, in a great measure, be repressed: and if a cask of prime cyder cannot from thence be obtained, a cask of tolerable second-rate kind may. These remedies are innocent: but if the farmer or cyder-merchant attempt to cover the accident, occasioned by negligence or inattention, by applying any preparation of lead, let him reflect, that he is about to commit an absolute and unqualified murder on those whose lot it may be to drink his poisonous draught.

The practice which is provincially termed *stumming*, and which signifies the fuming a cask with burning sulphur, may sometimes be advantageous. It is thus performed: Take a stripe of canvas cloth, about twelve inches long and two broad; let it be dipped into melted brimstone: when this match is dry, let it be lighted, and suspended from the bung of a cask (in which there are a few gallons of cyder) until it be burnt out. The cask must remain stopped for an hour or more, and then rolled to and fro, to incorporate the fumes of the match with the cyder;

after which it may be filled. If the stumming be designed only to suppress some slight, improper fermentation, the brimstone-match is sufficient; but if it be required to give any additional flavour to the cyder, some powdered ginger, cloves, or cinnamon, &c. may be strewed on the match when it is made. The burning these ingredients with the sulphur will convey somewhat of their fragrance to the whole cask of cyder; but to do it to the best advantage, it must be performed as soon as the vinous fermentation is fully perfected.

But when the cyderist has succeeded in obtaining a favourable vinous fermentation, and by a well-timed racking and attention he has prevented the acetous and other succeeding fermentations from rising, his cyder will require very little further attention more than filling up the vessels every two or three weeks, to supply the waste by the insensible fermentation, until the beginning of the next March: at which time it may be reasonably expected he will find his cyder bright and pure, and in a fit state for its final racking. This should be done in fair weather; and, if necessary, a commixture should now be made of the high-coloured cyder, made from the Jersey, or the luscious sweet apples, with that of the pale-coloured cyder from the poorer sour apples: by which means a general regular colouring may be obtained with the least trouble, and without expense.

Although it may be expected that the cyderist will now find his liquor to his mind, both in point of brightness and colour, yet should he be disappointed, it is now the time for applying some innocent remedy to remove the disorders. He does not recommend to him either of the *forces* commonly used for fining liquors, namely, bullock's blood, isinglass, eggs, &c. as they as frequently spoil a cask of cyder as improve it; but if he puts two pounds of lump sugar into a hogshead of cyder, he will receive all the benefit which may be expected from the most nauseous force which nastiness can employ. If higher colour in cyder be desired than what his fruit naturally gives under the foregoing management, the cyderist will do well to melt a pound of lump-sugar in a stewpan, over a clear fire, stirring it frequently, until it comes to a very dark-brown colour: then to take it off the fire, and, as it cools, add some cyder thereto by little and little, and continue stirring it until it becomes a thin uniform fluid. This colouring, in the quantity of about a pint, more or less as occasion may require, to a hogshead, is very cheap and wholesome, tinges to perfection, gives no luscious sweetness, but rather an agreeable bitterness, and thus recommends itself to the nicer palates. Soon after this spring racking, but not till then, the casks may be gradually stopped, by first laying the cork on the bung-hole, and in a few days forcing it very tightly into it, covering it over with a layer of melted rosin.

In the following month, Mr. Crocker says, the cyder, in general, will be in a fit state for bottling; but the critical time for this process is when the liquor has acquired in the cask its highest degree of perfection: then, when the weather is fair, the barometer high, and the wind in some northerly point, let the bottles be filled, setting them by uncorked until the morning; then let the corks be driven very tightly into the necks of the bottles, tied down with small strong twine or wire, and well secured with melted rosin.

It is remarked by Mr. Knight, that cyders which have been made from good fruits, and have been properly manufactured, will retain a considerable portion of sweetness, in the cask, to the end of three or four years; but that the saccharine part, on which alone their sweetness depends, gradually disappears; probably by a decomposition and discharge of fixed air, similar to that which takes place in the earlier stages of their fermentation. Cyder is generally in the best state to be put into the bottle at two years old, where it will soon become brisk and sparkling; and if it possesses much richness, it will remain with scarcely any sensible change during twenty or thirty years, or as long as the cork duly performs its office.

In making cyder for the common use of the farm-house, he says, few of the foregoing rules are or ought to be attended to. The flavour of the liquor is here a secondary consideration with the farmer, whose first object must be to obtain a large quantity at a small expense. The common practice of the country is sufficiently well calculated to answer this purpose: the apples are usually ground as soon as they become moderately ripe; and the juice is either racked off at once as soon as it becomes bright, or more frequently conveyed from the press immediately to the cellar. A violent fermentation soon commences, and continues until nearly the whole of the saccharine part is decomposed. The casks are filled up and stopped early in the succeeding spring, and no further attention is either paid or required. The liquor thus prepared may be kept from two to five or six years in the cask, according to its strength. It is generally harsh and rough, but rarely acetous; and in this state, he believes, it is usually supposed to be preferred by the farmers and peasantry. When it has become extremely thin and harsh by excess of fermentation, the addition of a small quantity of bruised wheat, or slices of toasted bread, or any other farinaceous substance, will, he says, much diminish its disposition to become sour. But the above opinion is not, he thinks, well founded; they like it best when it possesses much strength with moderate richness, and when it is without any thing harsh or sour in its flavour; but they will drink it, and to a most extraordinary excess, even when it is really acetous.

An inferior kind of liquor is made, he says, by macerating the reduced pulp, from which the cyder has been pressed, in a small quantity of water, and regrinding it. The residue of three hogsheads of the latter yields about one of the former, which may be kept till the next autumn, and usually supplies the place of cyder in the farm-house for all purposes except for the labourers in the harvest. It is generally fit to drink very soon after it is made; and though no attention is ever paid to it during its fermentation,

it often remains, till near the end of the succeeding summer, more palatable than the cyder pressed from the same fruit.

It is observed by Mr. Donaldson, that the quantity of cyder and perry made for sale in the fruit districts is very great; but that used by the inhabitants is by various accounts much more considerable. These liquors are sold by the farmers in different states of preparation for market. Sometimes they are sold immediately from the press, sometimes after the first racking, and frequently not till ready for use. The price of cyder and perry always advances according as these liquors are in a prepared state for the consumer's use, as well as according to the quantity on hand, and the quality of the fruit whence it was made. Stire cyder, and squash-pear perry, for instance, always give much higher prices than what is made from any other sorts of fruit. The price of common cyder liquor, from the press, for a course of seven years, may be rated at from 15*s.* to 30*s.* the hogshead of 110 gallons; and common perry, from 12*s.* to 15*s.* Stire cyder, in the same state, sells for 5*l.* 10*l.* and sometimes 15*l.* the hogshead; and squash-pear perry, in ordinary seasons, from 4*l.* to 8*l.*

The produce of cyder or perry by the acre, can only, he says, be guessed at, by first ascertaining the number of trees. From an orchard of trees, in full bearing, half a hogshead of cyder may, in seasons ordinarily favourable, be expected from the fruit of each tree. As the number of trees on the acre varies from ten to forty, the quantity of cyder must vary in the same proportion, that is, from five to twenty hogsheads. Pear-trees, in equally good bearing, yield fully one-third more liquor: therefore, although the liquor extracted from pears sells at a lower price than that produced from apples, yet the value by the acre, when the number of trees is the same, is nearly on a par.

Notwithstanding there are many individuals in the cyder-districts, who evince much care and attention in the management of their orchard-grounds, trees, fruit, liquor, &c. yet this is by no means, he says, the common case; on the contrary, such general negligence prevails, and so imperfect are the modes in which this branch of husbandry is for the most part conducted, that many are of opinion, so much valuable land being occupied as orchards, is, in a national view, extremely unprofitable; and that, owing to the same causes, want of attention, and adopting improper modes of management, the farmers at large are also injured rather than benefited. While, says he, orchards continue to be considered as secondary objects only of the farmer's attention, as is the case at present, it can hardly be expected that the produce will be abundant, or the quality such as to recommend it to more general notice. In place, however, of condemning orchard-husbandry at large, it appears much more correct to recommend a general reform in the management; whereby liquors, that are both wholesome and agreeable, when well made, may be introduced into more general use, and so large an importation of foreign vinous liquors be rendered unnecessary. In place of planting only ten or a dozen of trees on the acre over an extensive tract of land, it would be more for the interest, and certainly much more convenient for the cyder-men, were they to allot a few acres, adjoining to their places of residence, for the sole purpose of growing fruit-trees. The loss and inconvenience of having fruit-trees scattered over an arable field are considerable. When the trees are full grown, they over-shadow, and consequently greatly injure, the crop below; the roots also spread to a great distance, and, besides impeding the ploughing of the ground, extract a great share of the nourishment that would otherwise go to support the crop of corn. The additional expense in gathering and carrying home a crop of fruit from an extensive fruit-ground, beyond what is incurred when four trees stand on the same space of ground which in the other case is occupied by one, also merits attention. Inconveniences as great and numerous result from having fruit-trees thinly scattered over a pasture-field. The grass under the shadow of the trees is very inferior to that in the open part of the field. The cattle must be excluded when the fruit begins to ripen, especially during and immediately after high winds, otherwise they would eat the fruit. The falling of the leaves in autumn is very destructive to pastures of all descriptions; and the same additional expense and trouble of gathering and carrying home the crop is also incurred. For these reasons, a close-planted cyder-orchard must, he thinks, be preferable to fields: and where the soil and situation are proper, the grounds stocked with full-bearing trees of the best sorts; and when the trees, the fruit, and the liquor are judiciously managed, it is impossible but, according to the produce and prices above stated, such grounds must turn out profitable, even supposing they produce but one crop, equal to that above mentioned, every third year. On the other hand, if the slovenly manner of conducting the various operations of cyder-making be persisted in, it would be in favour of the nation, and of the individuals concerned in that branch of husbandry, he supposes, that there were not a cyder-orchard in the island. Perhaps, on another account also, it might be for the interest of the farmers in the fruit-districts that orchards were abolished: the quantity of cyder annually used by the servants and labourers is so immense, that, considering the injury which the crops of grains and grass sustain from the lands being incumbered with trees, the labour of collecting and carting home the fruit, and the trouble attending the manufacturing it into liquors, this beverage must be a more serious article of expense than the generality of cyder-farmers are disposed to allow. See *Orchard.*

Cyder-*Cask*, a vessel employed for the keeping of the liquor. The choice of proper vessels to keep the cyder in after it has fermented is very material, no liquor being so apt as this to take the taste or twang of the cask. New vessels, though the wood be ever so well seasoned, are apt to give a disagreeable relish to all liquors, and remarkably so to cyder, unless due caution be used beforehand. Fre-

quent scalding with hot water, into which some handfuls of salt have been first thrown, or with water in which some of the pommage has been boiled, and washing afterwards with cyder, are the usual remedies against this evil, and seldom fail of removing it effectually. Of old casks, beer-vessels are the worst, as they always spoil cyder; and, in return, cyder-casks infallibly spoil beer. Wine and brandy-casks do very well, provided the tartar adhering to their sides be carefully scraped off, and they are well scalded.

Cyder-*Cloths*, such cloths as are used for containing the pommage in order to its being pressed. They are usually made of common hair-cloth; but such as is rather close in its texture is the best. The size is generally about four feet square; and they hold about two or three bushels, or as much as the mill can grind at once: and these are heaped over each other till the press is full. The larger presses will hold from eight to fifteen bags, which yield from one to two hundred gallons of liquor, according to the largeness of what is termed the *cheese*. To perform the work neatly, it is necessary to have two sets of these bags; for they clog and fur in pressing, and consequently become unfit for use till they have been washed and dried; so that, while this is doing, either the press must stand still, or another set be ready to employ it. But some, instead of hair-bags, lay long straw under the pommage, the ends of which they turn up over it; then cover the pommage entirely with fresh clean straw, upon which they spread another layer of pommage: and so on, alternately, till the press is full. Either of the methods will do; but those who are desirous of doing the work in the neatest and best manner, generally use bags.

Cyder-*Kin*, an inferior kind of cyder, made after the best sort has been drawn in the way mentioned above.

Cyder-*Mill*, a mill constructed for the purpose of grinding apples, in order to the expressing of cyder from them.

There are several kinds of these mills employed in different districts; but that which is the most commonly met with, is formed upon the same principles as those used by tanners in grinding bark. It is represented in *pl.* XVIII. *fig.* 9, and consists of a circular trough, in which a large flat stone moves round upon its edge, and reduces the apples it contains into a pulp. *m* is the stone set upon its edge; *n*, the spring-tree bar, or that to which the horse is fastened; *p*, *q*, *r*, the circular trough in which the stone moves; *t*, *l*, *v*, compartments or divisions for containing different sorts of apples.

Mr. Marshall, in the Rural Economy of Gloucestershire, remarks, that a mill-house, or an orchard-farm, is as necessary as a barn. It is generally one end of an out-building; or, perhaps, an open shed, under which straw or small implements are occasionally laid up. The smallest dimensions, to render it any way convenient, are twenty-four feet by twenty; with a floor thrown over it, at seven feet high; with a door in the middle of the front, and a window opposite; with the mill on one side, the press on the other side, of the window; as much room being left in front, towards the door, for fruit and utensils, as the nature of the mill and the press will allow.

The mill consists of a stone-wheel, provincially a runner, somewhat in the shape of a corn-mill stone, running on its edge in a circular wooden or stone trough, provincially the chace. The size of the runner varies from two and a half to four and a half feet diameter, and from nine to twelve inches in thickness; which, in general, is even, like that of a grind-stone, not varying, like that of a mill-stone: the weight, one or two tons. The bottom of the chace is somewhat wider than the runner, that this may run freely. The inner side rises perpendicularly, but the outer side spreads, so as to make the top of the trough some six or eight inches wider than the bottom: to give freedom to the runner, and room to scatter in the fruit, stir it up while grinding, and take out the ground matter. The depth, nine or ten inches. The outer rim of the trough is three or four inches wide; and the diameter of the inner circle, which the trough circumscribes, from four and a half to five feet, according to the size of the mill. This is sometimes raised by a table of thick plank fixed upon the stone, with a curb of wood, lessening to an angle, fixed upon the circumference of the trough, making the whole depth of the trough about equal to its width at the bottom. This lessens the quantity of the stone; and the plank upon the centre answers other purposes. The entire bed of a middle-sized mill is about nine feet, some ten, and some few twelve, feet in diameter: the whole being composed of two, three, or four stones, cramped together as one; and worked, or at least finished, after they are cramped together. The best stones are raised in the forest of Dean: they are mostly a dark-reddish grit stone (non calcareous), working with sufficient freedom, yet sufficiently hard for this intention. The bed of the mill is formed, and the trough partly hollowed, at the quarry; leaving a few inches at the edge of each stone uncut out, as a bond to prevent its breaking in carriage. Much depends on the quality of the stone. It ought not to be calcareous, in whole or in part, as the acid of the liquor would corrode it. Some of the Herefordshire stones have calcareous pebbles in them which being of course dissolved, leave holes in the stone. Nor should it be such as will communicate a disagreeable tinge to the liquor. A clean-grained grindstone grit is the fittest for this purpose. The runner, as has been seen, is moved by means of an axle passing through the centre; with a long arm, reaching without the bed of the mill, for a horse to draw by; and with a short one passing to an upright swivel, turning upon a pivot, in the centre of the stone; and steadied at the top, by entering a bearing of the floor, above. An iron bolt, with a large head, passes through an eye in the lower part of the swivel, into the end of the inner arm of the axis. Thus the requisite double motion is obtained, and the stone kept perfectly

upright (which it ought to be) with great simplicity, and without stress to any part of the machine. This is the ordinary method of hanging the runner. There is a more complex way of doing it, he says, but he sees no advantage arising from it. There are some mills, it seems, with two runners, one opposite the other. On the inner arm of the axis, about a foot from the runner, is fixed (or ought to be, though it is frequently wanting) a cogged wheel working in a circle of cogs, fixed upon the bed of the mill. The diameter of the wheel is determined by the height of the axis above the bed of the mill. The diameter of the ring of cogs, by the distance of the wheel from the centre of motion. The use of these wheels is to prevent the runner from sliding, to which it is liable when the mill is full; the matter, when nearly ground, rising up in a body before the stone. Besides, by assisting the rotatory motion of the stone, it renders the work more easy to the horse. These wheels require to be made with great exactness: and in a country where carpenters are unaccustomed to them, a mill-wright should be employed in fixing them. The situation of the mill is such as to leave a horse-path, about three feet wide, between the bed and the walls; so that a moderately sized mill, with its horse-path, takes up a space of fourteen or fifteen feet every way.

It is farther observed by the same author, that from his having remarked the simplicity, and high degree of perfectness, with which the sugar-mills grind the canes, or rather press out their juice between two plain iron rollers, the imperfections of the cyder-mill appear the more striking. But the sugar-cane, says he, is a long fibrous body: and readily passes through between the rollers; whereas fruit, being globular, and of a cellular substance, is not easily laid hold of, or, if caught, has no lengthened fibres to induce it to pass, like the cane, between plain rollers. It has, however, been found, that between fluted rollers it may be made to pass; and, in consequence, these rollers are in use, though not common. They are of cast iron, hollow, about nine inches diameter, with flutes or teeth, about an inch wide, and nearly as much deep. In general they are worked by hand, two men working against each other. Between these the fruit passes twice; the rollers being first set wide, to break it into fragments, and afterwards closer to reduce the fragments. But even this is not a perfect engine: in the residuum from the press many kernels are found. Besides, the acid of the fruit is liable to corrode the iron, and this, in return, to tinge the liquor; though neither of these inconveniences is acknowledged. In a country, however, where stone is not easily to be had, this may, perhaps be found the most eligible cyder-mill. But in this district, where stone is sufficiently plentiful, the stone runner and trough seem to be the most eligible mill at present known: though it appears highly probable, that, with attention and perseverance, a more perfect machine might be invented. Be this as it may, the present mill appears to be capable of improvement. It is at present an unfinished machine; he means when it is first turned out of the workman's hands: time and constant wear do that, in part at least, which the workman leaves undone. The acting parts of the machine, those which are to bruise the rind and crush the kernels, are the face of the roller and the bottom of the trough. But instead of their being adapted to each other, in such a manner as to effect these purposes with a degree of certainty, they are left in such a rough unfinished state as in a great measure prevents them, during the first fifty years at least, from performing that which is their principal intention. Instead of being worked over, and fitted nicely to each other, with the square and chisel, they are hewn over with the stone-mason's peck only; leaving holes and protuberances which would save even horse-beans from the pressure, much more the kernels of fruit. A runner which has been worn two-and-twenty years has often holes left in it, which would lodge half a dozen kernels with safety. To account for this absurdity seems, he says, impossible: perhaps the roughness was intended to prevent the runner from sliding; but the use of the cogged wheels has superseded this intention. Perhaps it was left to gather up the fruits with greater effect; but, surely, deep chisel marks, left in the form of flutes across the face, would have answered this purpose better, and would, perhaps, have laid hold of and fixed the kernels, so as to secure their being effectually broken, preferable to any other equally simple expedient. Or, perhaps, the custom was established when the uses of the rind and kernel were not known, and time has not yet corrected the error. He has been told, that the roughness is left to cut the fruit the faster on its being first put into the trough; and that on this ingenious principle some will peck their runners over as often as they wear smooth. To such cyder-makers he would recommend the hobnail mill, which would come much cheaper, rid work still faster, and save the expense of pecking. Be the origin or folly what it may, says he, it is painful to observe its effect. In this case, however, the folly, and, of course, its effect, may be easily removed. Having made the face of the roller as true as the square and the chisel can render it, work the bottom of the trough to it, until not a mustard-seed can escape them. The kernels of fruit are hard, slippery, and singularly difficult to fix; escaping pressure in a peculiar manner, and with singular alertness.

It is further remarked, that another improvement of the common cyder-mill appears to be much wanted; namely, a method of preventing the materials, in the last stage of grinding, from rising before the runner; and, further, a more mechanical way of stirring up, and adjusting them in the chace. Until these improvements be made, cyder-mills, says he, must remain, what most of them evidently are at present, imperfect machines.

The utensils belonging to a mill-house are few: the fruit is brought in carts or baskets, and the liquor carried out in pails. The hair-cloths, mentioned above, are the principal addition to the mill and press. The expense of fitting up a cyder-mill

house depends on the size and quality of the mill and press. One of a moderate size, for a farm, may be furnished completely for from twenty to twenty-five pounds. One on a small scale might be furnished for from ten to fifteen pounds; much depending on the distance of carriage of the stone. This expense is usually borne by the landlord. A mill-house substantially fitted up will last many years. He has observed a mill and press which, by the date upon them, have been set up more than twenty years, yet they appeared almost as fresh as new. Many of the old mills and presses, which are seen, may, compared with these, seem to be a century old; or, the mills more particularly, a greater age, and were probably the original mills of the farms they are upon.

Cyder-*Press*, a press constructed for the purpose of expressing the juice from apples, after they have been reduced in the cyder-mill. They are mostly made on the principles of the packing, the napkin, or the oil-press: but there are different kinds in use; two of which are represented in *pl.* XVIII. in which *fig.* 10 is a small cyder-press, by which the juice is pressed out of the pommage by means of a stone, or block of heavy wood, cut in the form of the frustrum of a cone, and moveable about the centre. The pommage being spread upon the bed of the press, this conical presser is turned round by means of a lever, inserted upon its basis; by which means the juice is forced out, and conveyed by notches cut in the bed, by means of a spout, to the vessel below.

Fig. 11, *pl.* XVIII. represents a large cyder-press: *a b*, is the base with its supporters; *c*, *c*, the cheeks, which are upright beams, whose lower extremities are sunk in the earth, where they are firmly fixed by cross-bars and masonry; being connected at the top by two beams, the lowermost of which contains the nut, or female screw: *d*, the screw, with its wheel; below which is the bearer, or large piece of timber on which the force of the screw is exerted, in order to sink the beams crossing the planks that cover the pommage, or cheese, as it is called: *g g* are the planks on which the pommage is deposited in hair bags, in order to be squeezed: these planks are cut in notches, to conduct the liquor to a vessel properly placed to receive it. The bed of the press is supported on a strong work of masonry. In this press the wheel forces down the screw and bearer upon the pommage, laid upon the bed of it in hair bags, by turning round the wheel, *h*; as by that motion the cord is wound round its axis, and the wheel fixed on the bottom of the screw turned round, and the bearer, together with the cross-planks under it, forced down upon the pommage.

Mr. Marshall, in the work mentioned above, observes that the situation of the press should be as near the horse-path of the mill as conveniency will allow, for the more easy conveyance of the ground materials from the mill to the press. The sizes of presses are various. The bed, or bottom, is about five feet square, of strong plank or of stone; placed on sleepers about a foot from the ground-floor, or raised on mason's work to two or three feet high. On each side rises a strong upright cheek, provincially a *sister*; and across the top (the upper surface level with the chamber-floor) lies a nut, of dimensions suitable to the size of the screw, which is usually about ten inches in diameter. The foot of the screw is square, with cross holes for inserting a lever; or has a wheel fixed round it for that purpose. A sinker, provincially the *bridge*, is hung beneath it, and steadied by the cheeks in the usual manner. The bed or floor of the press, which is now composed entirely of wood, or of stones, not of lead, has a channel cut a few inches within its outer edge, to catch the liquor as it is expressed, and convey it to a lip, formed by a projection on that side of the bed opposite to the mill; under which lip a stone trough, or wooden vessel, is sunk within the ground (when the bed is fixed low) to receive it. The press, as has been shown, is worked with levers of different lengths: first, a short one; next, one of a moderate size, by hand; and, lastly, with a strong bar eight or nine feet long, by means of a species of capstone, provincially a windlass; an upright post, about six inches in diameter, with a pike or pivot at either end; one of them being inserted in the ground-floor, the other in a bearing of the chamber. From the upper part of this post passes a very strong rope, with an eye at the end to receive the end of the bar; which has a cross pin, or a shoulder, a few inches from the end, to prevent the rope from slipping. In the lower part of the post, about three feet from the ground, is one or more holes, for a lever or levers. By these means an excessive purchase is obtained.

Cyder-*Vat*, a vessel made for the purpose of receiving the pommage, or the cyder before it is racked off into the cask. Vessels of this kind should be made of wood, as where lead is employed, it is liable to be corroded by the malic acid.

Cyder-*Wine*, a sort of wine made by evaporating the juice of apples nearly to one half; then cooling it, and fermenting it in a proper cask, in the common method. It is said to be a cooling pleasant liquor.

CYNOSURUS, a genus of grasses, of which there are three varieties that are occasionally met with in the field. The *dog's-tail grass.*

Cynosurus *cristatus*, the crested dog's-tail grass, which is found in the best pastures, such as parks and sheep-walks. It grows naturally in dry situations, but will not thrive well in such meadows as are wet. It flowers about the same time with the meadow fescue-grass, but is not very productive of foliage. From this circumstance, and that of its stems being wiry and constantly refused by cattle, as well as from its roots being fibrous, and penetrating to no great depth, Mr. Curtis thinks it little better than an annual, consequently inferior to many other grasses. Sheep are, however, extremely fond of feeding upon it.

Cynosurus *echinatus*, the rough dog's-tail grass. This grass, from its being an annual, is scarcely worthy of cultivation.

Cynosurus *cœruleus*, the blue dog's-tail grass;

which, as it is liable to grow in hassocks in pastures, is of little value.

CYSTOCELE, in *farriery*, is a hernia or rupture formed by the protrusion of the urinary bladder.

CYTISUS, the name of a plant formerly cultivated as the food of cattle. It is called by some *shrub-trefoil*, and by others *shrub-lucerne*. It rises to the height of five, six, or even more feet, with a shrubby stalk, covered with a greyish bark, and divided into many branches, which have upon them a hoary down while they are young, and garnished at each joint with trifoliate leaves, standing upon foot-stalks about an inch in length. There are two or three of these at each joint, so that the branches are closely covered with them. The lobes are small, spear-shaped, and hoary on their under-side; and these leaves remain all the year. The flowers, which are of a bright yellow, blow on foot-stalks which arise from the sides of the branches, each foot-stalk sustaining four or five flowers; and these are succeeded by compressed moon-shaped pods, each containing three or four kidney-shaped seeds.

This plant may be raised either from seed sown about the middle of October, or in the beginning of April; or, if greater speed be required, from slips or layers, planted in the spring or autumn, so as to leave a space of four feet between each plant. These are the directions of Columella; who adds, that if the ground be well dunged for this planting, and well hoed up round the plant, which should be watered during the first fortnight, if rain does not fall, plentiful crops may be obtained from this excellent vegetable, equally fit for horses, oxen, cows, sheep, hogs, goats, and poultry. It is also said to be singularly profitable for bees, whose honey it increases prodigiously. It has the same effect upon the milk of cows, besides greatly improving its quality. In the kingdom of Naples the goats feed upon it, and great quantities of excellent cheese are made from their milk. It will bear cutting as often as its shoots are about fifteen or eighteen inches long, which may be several times in the year; for it shoots and flowers during eight months in the countries where it grows well, and continues green during the whole winter, if the season be at all favourable. Its seeds begin to ripen towards the end of August, and continue to do so until the cold stops them. It will be fit for cutting at the end of three years at farthest, and should be carefully kept clear of weeds, and hoed up between each cutting. If given as green fodder, which it affords during eight months of the year, about fifteen pounds weight of it are said to be sufficient for the daily food of a horse, twenty pounds for an ox, and so in proportion for other cattle, according to their size and strength. When made into hay, it should be given more sparingly, because it is then more nourishing. In this state it should be steeped in water before it is given to cattle, and then be mixed with chaff or straw. The time of cutting it for hay is when the greater part of its seeds begin to grow large; and the manner of making the hay is, to let the swarths lie some hours in the sun, till they are just faded, and then to dry them thoroughly in the shade.

Mr. Miller allows the cytisus every quality that can recommend it for the feeding of cattle in the countries where it grows naturally, such as the islands of the Archipelago, Sicily, and the warmest parts of Italy; but is persuaded that it will not thrive in England so as to be of any real advantage for that purpose, because it cannot bear such hard frosts as we sometimes have: or, if it does bear them so far as not to be absolutely killed, it will be so much injured thereby, as not to be able to recover its verdure before the middle or latter end of May, nor even then to put forth shoots that will bear cutting more than once in a summer; besides their being so woody, if suffered to grow to any considerable length, as to render that cutting very troublesome, and of little service by way of fodder. He therefore thinks, upon the whole, that it can never answer the trouble and expense of cultivation in this country, where we have many other preferable plants; but that in hot, dry, rocky countries, of which we have now several in our colonies, where few other vegetables will thrive, this may be cultivated to great advantage, for it will live there many years, and prosper very well.

D.

DABBING, a term sometimes applied to dibbling.

DAB-CHICK, a term applied to a chick newly hatched.

DACTYLIS, the name of a genus of grasses which are of but little value for cultivation. The *Cock's-foot Grass.*

DACTYLIS *glomeratus*, rough cock's-foot grass; a hard productive grass common in meadows, and rather early. It is supposed by some to be useful on clayey, moist, and loamy soils, and where the other grasses are liable to be over-powered by the natural herbage. When kept close fed down, it affords good pasturage for sheep, but in other circumstances gets coarse. It forms a better sward when sown with red-clover, and the clover lasts longer in the land. It is said to grow better than most others in the winter, and to afford an early sheep-feed. Others, however, contend that it is a very coarse ordinary grass, which is rejected by almost all sorts of cattle, and that it is injuriously prevalent in some pastures.

DAG, a term provincially applied to dew hanging upon the grass.

DAIRY, the place where milk is kept, and where butter and cheese are prepared and preserved. They are distinguished into butter, cheese, and milk-dairies, according as one or other of these articles is the principal object of the dairy.

It has been observed by Dr. James Anderson, in a paper in the fifth volume of the Bath Agricultural Society, that when a dairy is established, the undertaker may sometimes think it his interest to obtain the greatest possible quantity of produce; sometimes it may be more beneficial for him to have it of the finest quality, and at other times it may be necessary to have both these objects in view, the one or the other in a greater or less proportion; it is therefore of importance he should know how he may accomplish the one or the other of these purposes, in the easiest and most direct manner. To be able to convert his milk to the highest possible profit in every case, he ought to be fully acquainted with every circumstance respecting the manufacture both of butter and of cheese; as it may in some cases happen that a certain portion of that milk may be more advantageously converted into butter than into cheese, while another portion of it would return more profit if made into cheese. See *Butter* and *Cheese.*

DAIRYING, the art of making cheese, butter, and other dairy products.

It has been remarked by a late practical writer, that "there are some sorts of grass-lands that answer better in this management than others. It is not well decided, though general experience seems to favour the opinion, that the very fertile pasture-lands may be more profitably applied to the purpose of grazing or fattening animals than that of dairying; but such as are not capable of bringing the larger sorts of cattle to a complete state of fatness, and which usually let from twenty to five-and-twenty shillings the acre, may be more profitably employed in this way. And that most of the low and more moist kinds of meadow-lands, which though the value may be high, as they do not succeed so well for the purpose of fattening, may be found highly useful for the dairy. The high, open, and exposed uplands are always less proper for this sort of practice than those which are situated lower, are more inclosed, and warm."

It is likewise added, that in regard to "the management of the business, the nature of the pastures and other sorts of food which the farmer has at command, must direct him in the extent and kind of dairying which he is to pursue."

It is suggested, that "where the grass-lands are of the older kinds, and tolerably rich and fertile, butter should probably, in general, be the principal object; but where they have been more recently converted to the state of sward, and are of a more cool as well as less rich quality, cheese may be the most depended upon." And that "it is perhaps only under particular circumstances and situations that the different methods can be combined with profit and convenience. There are, however, cases in which this may be attempted with great advantage" in various respects.

It is added, that "it has been an observation in dairying, founded upon long experience, that such lands as have been for a great length of time in the state of pasture afford milk that abounds more in the oily material, or cream; while those which have been a less time in that state, and are of a more cold nature, are more productive in such milk as has the caseous matter in a large proportion to that of the cream." This Mr. Marshall has fully shown in his Rural Economy of the Midland Counties.

And, "in Yorkshire," it is observed in the Report

of that district, that "the dairy-farmers are in many cases in the habit of preserving their old pastures in their original state, as they find the milk produced on them churns with more facility, and the butter is capable of being kept better than if such naturally rich grounds were highly improved. In some cases it has been found that there was great difficulty in making as well as preserving the butter, especially in the more warm months, where the land had been wholly ploughed up and improved by manure, particularly of the calcareous kind, where there was previously no difficulty of that sort, and the butter was of the best sort." It is consequently concluded, that "old pastures have, besides the property of supplying the butyraceous material in greater abundance, that of rendering the butter more firm and waxy."

Doctor Anderson has likewise observed, that "the richness of the butter in the Highlands of Scotland has been universally attributed to the cows feeding upon the old grass in their remote glens; though it is suggested that this may partly depend on the management that is adopted in making it." And Mr. Young, in his Six Months Tour, states, that "in Cheshire they find the inferior sorts of pasture-lands are the best suited for cheese."

On these facts it is remarked by the first writer, that "though this may in some degree be the case, there cannot be any doubt but that good butter may be made in many instances where the cows are kept in new pastures, and that excellent cheese may also be prepared where the lands that are employed as pastures have been long in the state of herbage. Butter equally rich and good with that made while the cows were grazed on the rich old pastures, has indeed been known to be sometimes prepared when they were fed with cut clover and rye-grass in the stall."

The writer first mentioned, also, after stating that "it has not been shown by any set of experiments that can be fully depended upon, whether the butter or cheese-dairy affords the largest profit to the farmer, when conducted under equally good management;" observes that "the most valuable part of the milk is in each case converted into a substance of great utility; and though the former sells for a considerably higher price than the latter, from the differences in the quantity of the products in the expense and trouble of management, and various other circumstances, it seems that the real advantages are nearly equal. It has been stated, he says, before the late rise in the prices of these different articles, to amount, whether of butter and butter-milk, or of cheese and whey, to nearly fourpence-halfpenny for each gallon of milk; at present, perhaps, little less than from sixpence to sixpence-halfpenny." He however thinks, that "in the vicinity of large towns, and wherever butter is constantly in great demand, it may be more profitable to have a butter-dairy instead of that of the cheese kind."

There can be little doubt that in this, as well as many other sorts of business, "much of the profit must constantly depend upon the care and assiduity that is bestowed in conducting the different processes of the art. It has been observed, that this kind of management should only be undertaken by those who are capable of paying the most minute attention to every department of it; as, unless this becomes a fixed and established principle in the farmer's mind, the chance of success is precarious and uncertain. To trust wholly to common servants, in this sort of business, is always hazardous, and never to be practised where it is carried on to any extent." And that, in undertaking it, "the first thing that is necessary is that of being provided with a sufficiently large and convenient dairy-house, whether the object be cheese or butter. It should be so proportioned to the number of cows, as that there may be sufficient convenience for performing all the necessary operations without embarrassment; and much attention must be paid to cleanliness in every thing that relates to it, such as the shelves, floors, and different implements which are made use of, by daily scalding, scrubbing, rinsing, and drying, in order to prevent any sort of acidity taking place, as, without due regard in these respects, it is impossible that the produce can be of superior quality, or such as will keep sweet and good for any length of time, &c. Cleanliness may indeed be said not only to be necessary in dairy-husbandry, but to be the foundation of it, and the most essential and least indispensable part of good management." For it is observed, that "a farmer may be in possession of the most valuable breed of cows, and these be fed on the richest pastures; but unless cleanliness prevail in the dairy, his butter or his cheese will never stand high in general estimation. Next to the size and situation of the dairy-house, and to keeping it and the utensils clean, is that of skill and attention in the general management. In short, without a knowledge of the best modes proper to be adopted under different circumstances, and a regularity, method, and prompt attention to their execution, it is obvious that the business must soon run into confusion, and become unprofitable" to the undertaker.

In respect to the expense of the necessary apparatus for carrying on a business of this sort, such as churns, milk-pails, cheese-cloths, trays or pans, brass milk-kettle and boiling-copper, &c. exclusive of the cheese-press, for a dairy of twenty cows, they will cost from fifty to sixty pounds. In regard to fuel, either coal or wood answers the purpose, but faggots preserved in the stack one year are the best material that can be employed.

Mrs. Chevallier, according to Mr. Young, finds it essential that the trays in which milk is set, "should be scalded with hot water, or else warmed by the fire, before the milk is set in them" in winter. And that "all trays should be of deal, about three inches and a half deep: they are preferable to leaden ones, which not only blister when hot water is poured into them, but are also said to be unwholesome. About twelve square yards of tray, with some spare bowls, will do for twenty cows. The churn for such a dairy should contain about 50 gal-

lons, beer measure. The copper should hold 100 gallons."

The next thing to be attended to in an undertaking of this nature is, to choose cows of a proper sort. Among this class of animals it is found, by experience, that some kinds give milk of a much thicker consistence and richer quality than others; nor is this richness of quality necessarily connected with the smallness of the quantity yielded by cows of nearly an equal size; it therefore behoves the owner of a dairy to be peculiarly attentive to this circumstance. In judging of the value of a cow, it ought rather to be the quantity and the quality of the cream produced from the milk of her in a given time, than the quantity of the milk itself, that should be regarded:—this is a circumstance that will be shown in future to be of more importance than is generally imagined; but where cheese is the object, both the quality and proportion should be considered. The small cows of the Alderney breed afford the richest milk hitherto known; but individual cows in every country may be found, by a careful selection, that afford much thicker milk than others; these, therefore, ought to be searched for with care, and their breed reared with attention, as being peculiarly valuable. See *Cow*.

Few persons who have had any experience at all in the dairy-way can be ignorant, however, Dr. Anderson says, that in comparing the milk of two cows, to judge of their respective qualities, particular attention must be paid to the time that has elapsed since their calving: for the milk of the same cow is always thinner soon after calving than it is afterwards, as it gradually becomes thicker, though generally less in quantity, in proportion to the time the cow has calved. The colour of the milk, however, soon after calving is richer than it afterwards becomes; but this, especially for the first two weeks, is a faulty colour that ought not to be coveted.

It is suggested, that "on the richer and more fertile pastures, it is probable that the large and middle breeds of cows may be the most beneficial, especially where both cheese and butter are made: but in such as do not possess such a high degree of fertility, the middle and smaller breeds may prove more profitable to the dairy-farmer. Some suppose the long-horned breed not well suited for the dairy; but experiments that have been carefully made show, that more cheese may be produced from the same quantity of milk in that breed than in those of the short-horned, as well as more butter from the same quantity of cream. And, in Ireland, the Craven breed afforded more butter than the Holdernesse. Of the smaller breeds, the Alderney, the Suffolk polled, and the Kiloe or Scotch breeds, may be found the most profitable. In the dairies of the Isle of Wight, as well as those of some parts of Hampshire, the Alderneys prevail much, and are highly esteemed for butter. Two-thirds of the Suffolk polled breed, and one-third Alderney, have been recommended in the Annals of Agriculture, as constituting an excellent dairy, the milk being mixed."

There is, however, independent of the milk, "another object to be attended to in forming a cow-stock for dairying, which is, that they be sufficiently hardy for the situation. In this respect, the long-horned breed is much superior to the short-horned cattle, from the difference in the thickness of their hides; and the Scotch is probably better than either. This breed and the long-horned are therefore the most proper for bleak, exposed situations." And "as many of the mixed breeds afford excellent milkers, and in most of the genuine breeds there are great differences in the individuals, it may be the best mode, in order to establish a good dairy, whether for cheese or butter, for the farmer to breed from such cows, of whatever kind they may be, as he has found from experience the best for the purpose, without being at the trouble of purchasing the more expensive breeds. In this case, good bulls should always be procured, as much is supposed to depend on the male" animal in these cases.

There is likewise another circumstance that requires to be regarded, "in order to produce abundance of milk, and of a good quality, which is, that the cows must at all times have plenty of food." There can be no doubt, but that "grass is the best food for this purpose, and that kind of grass which springs spontaneously on rich dry soils is supposed the best of all" by some dairy-farmers.

In regard to the keeping of the cows, especially in the winter-season, "there are different methods in use; but in the southern parts of the island they do extremely well in warm sheltered yards, with open sheds, especially when plenty of litter, such as straw, stubble, fern, or other similar materials can be afforded for keeping the whole well bedded." But "in the northern districts, and wherever a proper supply of litter cannot be obtained, it is better to have them tied up in stalls, with raised standings, and sunk paved floors immediately behind them for receiving the dung and urine, as by these contrivances they may be kept perfectly clean without litter, and at the same time be more warm, as two cows may be confined in the same stall. The stalls should be kept constantly clean and well sweeped out."

With respect to the pasturing of the cows, it has been observed, that "if the temperature of the climate be such as to permit the cows to graze at ease throughout the day, they should be suffered to range on such pastures at freedom; but, if the cows are so much incommoded by the heat as to be prevented from eating through the day, they ought in that case to be taken into cool sheds for protection; where, after allowing them a proper time to ruminate, they should be supplied with abundance of green food fresh cut for the purpose, and given to them frequently, in small quantities, fresh and fresh, so as to induce them to eat it with pleasure. When the heat of the day is over, and they can remain abroad with ease, they may be again turned into the pasture, where they should be allowed to range with freedom all night during the mild weather of summer."

There is a sameness in almost every district of the island, in the management of the cows in the summer-season. "They are usually kept on the oldest pastures on the farm; when these are at a distance from the farm-house, they are milked on the pastures; but otherwise they are brought home morning and evening for that purpose." It is, however, improper to drive them to any distance in this sort of management.

"The dry cows, or such as do not give milk, are, in the winter, fed on straw in the straw-yard; while those that are in milk, or are near calving, are kept in some inclosed pasture, or in sheds erected for the purpose, and maintained chiefly on hay. Where artificial grasses, turnips, cabbages, or potatoes, are cultivated on a large scale, the milch cows have a daily and regular allowance of one or other of these sorts of food during the winter and spring months. Potatoes in particular are admirable food for cows; as, while they tend to keep them in good condition, the quantity of milk is generally abundant and of good quality, both in respect to richness and flavour. In short, the dairy-farmer, in every part of the island, will find it for his interest to be attentive in feeding his cows" with these different sorts of food.

It has been suggested, that the various sorts of food that are thus employed, may be disposed of in the summer and winter-seasons somewhat in the following way: "In summer, red-clover, saintfoin, lucerne, burnet, and tares may be made use of with great advantage. But in employing the first, great care should be taken to guard against injury, either to the animals, or the quality of the butter or cheese being rendered of a bad kind or flavour by it. On poor chalky hills, the second will be of the greatest importance to the dairy-farmer. Lucerne and tares should always be employed in the way of soiling; in which method, where the cows have proper shade and sufficient water, they will be found of the utmost use, as they afford a very certain supply of food, and go a great way. Besides, the cows are found to milk well in this management, where proper attention is bestowed in the foddering of them. Some suppose it a method that can hardly be too strongly advised. In Mr. Baker's experiments, a middle-sized cow was found to consume in the proportion of from 90 to 100 pounds of green lucerne in the course of twenty-four hours."

And "for winter, hay, straw, cabbages, turnips, carrots, potatoes, cole, malt-grains, &c. may be made use of. The keeping cows with hay is in general too expensive to afford the dairy-man an adequate profit: therefore, in order to lessen the expense of this sort of keep, other articles of the green and root kind must be had recourse to: till near the period of calving, they may be supported on fresh threshed straw in cribs in the fold-yard, beginning with the worst, and gradually proceeding to that which is of a better quality. Those in good condition should have the worst straw; but when it is not of the best kind, and the cows are of a valuable sort, they may be fed once a day with cabbages, turnips, or other similar sorts of food, in bins for the purpose. When within about a month or six weeks of calving, a little hay should be given at night, or the allowance of green food increased, and on the day of calving they should be confined, and have warm water; and for a fortnight after calving be very well fed with both hay and green food, in suitable divisions for the purpose. In this view the cabbages are extremely valuable, as the produce on the acre is large, and they afford much milk; but care must be taken to pick off all the dead and decayed leaves, which may be given to the young stock. A middle-sized cow will consume from one to two hundred pounds in a day, but seventy is supposed as much with straw as can be paid for by the produce. In Mr. Dodsworth's trials, a cow of fifty stone was found to eat twelve stone of this sort of food in the same time. An extent of this kind of crop proportioned to the dairy should always be provided. The only objection to turnips as food for milch cows is their impairing the flavour of the butter: but they are a sort of food that affords much milk; and without this, or the preceding green food, a large dairy cannot perhaps be supported to much profit. A larger weight of this food than the former is consumed in the same time."

Besides these, "carrots and potatoes are very advantageous sorts of food for cows, where they are raised in great abundance; but even in such cases they can only, it is supposed, be made use of with profit as a feed once or twice in a day with other sorts of food. It is out of the question that a cow could pay for being kept wholly on them. Cole, as being fed-off in the field, can only be had recourse to on the firm dry soils; but in such situations it is a very profitable crop applied in this way, especially when used in succession to turnips in the spring-months. Malt-grains, where they can be had in plenty, are useful with other sorts of food, as producing a large proportion of thin milk. They are consequently better for the purposes of the milkman than the dairy-farmer," where butter is the principal object.

The author of Practical Agriculture has well remarked, that "whatever kinds of green or succulent food may be used in the way of feeding dairy-cows, experience has shown that great advantage may be derived from varying them as much as possible, probably on the physiological principle that the novelty of stimulus is the most powerful in exciting the action and promoting the secretions of the system. The use of day and night pastures, which is a method employed in some districts, as Cheshire, may also partly, he thinks, depend on this principle, and partly on that of better shade and water" being afforded.

The business of turning the cows into the pastures, should always be done with care, and "according to their goodness: such grass-lands as afford in rent, tythe, and taxes, twenty-seven or eight shillings, may support during the summer-season in the proportion of a cow of fifty stone to an acre and a half with a few sheep. But in such as are not

worth more than twenty shillings, one cow to two acres may be often fully sufficient;" as "the rule should be, for the pastures never to be too closely stocked" in this sort of management.

In respect to the milking of the "cows, it is in general only performed twice in the day; but, when abundantly fed, they should probably be milked three times a day during the whole of the summer season: in the morning early, at noon, and in the evening just before night-fall. For, if they be milked only twice in the twenty-four hours, while they have abundance of succulent food, they will yield a much smaller quantity of milk in the same time, than if they were milked three times.

"In the choice of persons for milking the cows, great caution should likewise be employed: for, if that operation be not carefully and properly performed, the quantity of the produce of the dairy will be greatly diminished. It should be a rule never to allow this important department to be entrusted without control to the management of any but very trusty servants; as the cows should always be treated with great gentleness."

And it has been considered as a matter of "great consequence to the produce of the dairy, that the cows should not drop their calves too early in the season. When that happens, they fall off in the quantity of milk in the autumn, when, owing to its superior richness, it is more valuable than at any other period. From the end of March to the end of April is the best time in the more northern districts that a cow can drop her calf, as she soon gets into good condition on the early grass, and yields a greater quantity of milk in the course of the season than those that calve either considerably earlier or later. But in the more southern districts of the kingdom, it is beneficial to the dairy-farmer to have them calving at a much earlier period."

The labour necessary in dairy-business, must obviously "be different, according to the difference of convenience and other circumstances; but a common dairy-maid can seldom manage more than twelve or fourteen cows in a perfect manner, especially where both butter and cheese are made. If she undertake more, she will require assistance in the dairy." And "as the cows should not be more than an hour in milking, the maid cannot milk more than five or six; in a dairy of about eighteen cows, two assistants will consequently be required at such times; which in summer, when two milkings only are practised, should be at five o'clock in the morning and six at night. The work of the dairy must therefore be regulated in this proportion" as much as possible. And it is a "practice constantly to be inculcated, for the dairy-maid to examine the cows separately after the milkers, especially when they cannot be fully depended upon; to see that the business has been perfectly performed; as, where the contrary is the case, loss may not only be sustained in the richest part of the milk being left, but the cows be more subject to become dry as well as diseased in their udders."

As the proper management of the milk is a point that next requires attention, and upon which much of the success of the dairy-business depends, the following facts stated by Dr. Anderson in the fifth volume of the Bath Papers, as the result of accurate experiments, on the nature of milk and the proportion and separation of cream from it, deserve the attention of the dairy-farmer. It was found first, that "of the milk that is drawn from any cow at one time, that which comes off at the first is always thinner, and of a much worse quality, than that which comes afterwards; and that the richness goes on, continually increasing, to the very last drop that can be drawn at that time. Few persons, says he, are ignorant that the milk which is taken from the cow last of all at milking is richer than the other parts of it; but very few are aware of the greatness of the disproportion between the quality of the first and the last-drawn milk from the same cow at one milking. The following facts in respect to this circumstance were ascertained many years ago, and have been confirmed by subsequent experiments and observations. "Having taken several large teacups, exactly similar in size and shape, and filled them at regular intervals, the last being filled with the dregs of the milk; these were each weighed, so as to ascertain that the quantity of milk in each was precisely the same. From a great number of experiments, frequently repeated with many different cows, the result was in all cases thus: The quantity of milk obtained from the first-drawn cup, in every case, was much smaller than from that which was last drawn; and those between afforded less or more as they were nearer the beginning or the end. It is unnecessary, he says, to specify intermediate proportions; but the quantity of cream obtained from the last-drawn cup, from some cows, exceeded that from the first in the proportion of 16 to 1. In other cows, however, and in particular circumstances, the disproportion was not quite so great; but in no case did it fall short of the rate of 8 to 1. Probably, upon an average of a great many cows, it might be found to run as 10 or 12 to 1."

In the next place, he observes, "the difference in the quality of the cream obtained from the two cups was much greater than the difference in the quantity. In the first cup the cream was a thin tough film, and very white; but in the last of a thick butyraceous consistence, and of a glowing richness of colour, that no other kind of cream is ever found to possess." And "the difference in the quality of the milk that remained after the cream was separated, was perhaps, he says, still greater than either, in respect to the quantity or the quality of the cream. In the first cup it was a thin blueish liquid, as if a very large portion of water had been mixed with ordinary milk; while in the last cup it was of a thick consistence and yellow colour, more resembling cream than milk both in taste and appearance. From this experiment it appears, he thinks, that the person who, by bad milking of his cows, loses but half a pint of his milk, loses in fact about as much cream as would be afforded by six or eight pints at the beginning; and besides, that part of the cream

which alone can give richness and high flavour to the butter, where that is the object, is lost.

"Secondly. That if milk be put up in a dish, and allowed to stand till it throws up cream, that portion of cream which rises first to the surface is richer in quality and greater in quantity than what rises in a second equal portion of time; and the cream that rises in the second interval of time is greater in quantity and richer in quality than that which rises in a third equal space of time; and that of the third than the fourth, and so on, decreasing in quantity and declining in quality continually as long as any rises to the surface. These experiments not having been, in this case, made with so much accuracy as in the former, the Doctor has not been enabled to ascertain the difference in the proportion that takes place in equal portions of time; but they have been so often repeated as not to leave any room to doubt the fact: and it will be allowed to be a fact of no small importance in the management of the dairy. It is not clear, however, but that a greater quantity of cream may upon the whole be obtained from the milk by taking it away at different times; but the process is so troublesome as not to be counterbalanced by the increased quantity obtained; if, indeed, an additional quantity be thus obtained, which is not as yet fully ascertained.

"Thirdly. That thick milk always throws up a smaller proportion of the cream it actually contains to the surface than milk that is thinner; but the cream is of a richer quality: and if water be added to that thick milk, it will afford a considerably greater quantity of cream than it would have done, if allowed to remain pure; but its quality is at the same time greatly debased. This is a fact that every person attentive to a dairy must have remarked; but no experiment has been made that could ascertain either the precise amount of the increased quantity of cream that might thus be obtained, or of the ratio in the decrease of its quality: but it ascertains the effects, at least, of mixing water with the milk in a dairy; and the knowledge of this fact will enable attentive persons to follow that practice which they think will best promote their interest.

"Fourthly. That milk which is put into a pail, bucket, or other proper vessel, and carried in it to any distance so as to be much agitated, and in part cooled before it be put into the milk-pans to settle for cream, never throws up so much nor so rich cream as if the same milk had been put into the milk-pans directly after it was milked. In this case it is believed, that the loss of cream will be nearly in proportion to the time that has elapsed, and the agitation it has sustained after being drawn from the cow: but the author is not yet in possession of any experiments that sufficiently ascertain how much is to be ascribed to the time and the agitation taken separately."

It is supposed that from the whole of these facts and circumstances, the following corollaries are fairly deducible: "1st, That it is of importance that the cows should be always milked as near the dairy as possible, to prevent the necessity of carrying and cooling the milk before it be put into the dishes: and as cows are much hurt by far driving, it must be a great advantage in a dairy-farm to have the principal grass-fields as near the dairy, or homestead, as possible. 2dly, That the practice of putting the milk of all the cows of a large dairy into one vessel, as it is milked, there to remain till the whole milking be finished before any part of it is put into the milk-pans, seems to be highly injudicious, not only on account of the loss that is sustained by agitation and cooling, but also, more especially, because it prevents the owner of the dairy from distinguishing the good from the bad cow's milk, so as to separate these from each other where it is necessary. He may thus have the whole of his dairy product greatly debased by the milk of one bad cow, for years together, without being able to discover it. 3dly, Tha if it be intended to make butter of a very fine quality, it will be advisable in all cases to keep the milk that is first drawn separate from that which comes last; as it is obvious that if this be not done, the quality of the butter will be greatly debased, without much augmenting its quantity. It is also obvious, that the quality of the butter will be improved in proportion to the smallness of the proportion of the last-drawn milk that is retained; so that those who wish to be singularly nice in this respect, will do well to retain only a very small proportion of the last-drawn milk. To those owners of dairies who have profit only in view, it must ever, he says, be a matter of trial and calculation, how far it is expedient for them to carry the improving of the quality of their butter, at the expense of diminishing its quantity. In different situations, prudence will point out different kinds of practice as most eligible; and all persons must be left, after making accurate trials, to determine for themselves. It is likewise a consideration of no small importance, to determine in what way the inferior milk that is thus to be set apart, where fine butter is wanted, can be employed with the greatest profit. 4thly, That if the quality of the butter be the chief object attended to, it will be necessary not only to separate the first from the last-drawn milk, but also to take nothing but the cream that is first separated from the best milk, as it is this first rising cream alone that is of the prime quality. The remainder of the milk, which will be still sweet, may be either employed for the purpose of making sweet-milk cheeses, or it may be allowed to stand to throw up cream for making butter of an inferior quality, as circumstances may direct. 5thly, That, from the above facts, we are enabled to perceive that butter of the very best possible quality can only be obtained from a dairy of considerable extent, when judiciously managed; for when only a very small portion of each cow's milk can be set apart for throwing up cream, and when only a very small proportion of that cream can be reserved as of the prime quality, it follows that, unless the quantity of milk were upon the whole very considerable, the quantity of prime cream produced would be so small as to be scarcely worth the while for manufacturing

separately. 6thly, That from these premises we are, he says, also led to draw another conclusion, extremely different from the opinion that is commonly entertained on this subject, viz. That it seems probable that the very best butter could only be with economy made in those dairies where the manufacture of cheese is the principal object. The reasons are obvious:—If only a small portion of the milk should be set apart for butter, all the rest may be made into cheese while it is yet warm from the cow and perfectly sweet; and if only that portion of cream which rises during the first three or four hours after milking is to be reserved for butter, the rich milk which is left after that cream is separated, being still perfectly sweet, may be converted into cheese with as great advantage nearly as the newly-milked milk itself. But as it is not probable that many persons could be found, who would be willing to purchase the very finest butter made in the manner above pointed out, at the price that would be sufficient to indemnify the farmer for his trouble in making it, these hints are thrown out merely to satisfy the curious in what way butter possessing this superior degree of excellence may be obtained, if they choose to be at the expense: but, for an ordinary market, the Doctor is satisfied, from experience and attentive observation, that if in general about the first-drawn half of the milk be separated at each milking, and the remainder only be set up for producing cream, and if that milk be allowed to stand to throw up the whole of its cream, even till it begins sensibly to taste sourish, and if that cream be afterwards carefully managed, the butter thus obtained will be of a quality greatly superior to what can usually be obtained at market, and its quantity not considerably less than if the whole of the milk had been treated alike. This, therefore, is the practice that is thought most likely to suit the frugal farmer, as his butter, though of a superior quality, could be afforded at a price that would always insure it a rapid sale."

Mr. Young states, that "Mrs. Chevallier, a lady very attentive to a very successful dairy, remarks, that in winter, it is a good way to add hot water to milk, directly as it comes from the cow; it makes it yield the cream."

It is further stated, that "among other reasons that induced the Doctor to separate about the half of the milk, is the following: Whilst he was employed in making experiments on milk, it chanced that among his cows there was one which had missed having a calf that season, and still continued to give milk. Her milk, as is not uncommon in these circumstances, tasted sensibly salt. On trying the different parcels of that milk, however, it was perceived that the first-drawn milk was extremely salt to the taste, and that the last was perfectly sweet. On an after-trial, made with a view to ascertain what proportion of the milk was salt, it was found that the saltness decreased gradually from the beginning, and was entirely gone when nearly one half of the milk was drawn off, so that all the last-drawn half of the milk was quite sweet. He intended to have tried if other nauseous tastes that sometimes affect milk, such as that from turnips, cabbages, &c. were peculiarly confined to the first-drawn milk or not; but other avocations prevented him from ascertaining this fact."

When the milk has been brought from the cows, where the object is the making of butter, "it should be passed through a sieve or strainer of hair or silver wire, fixed in the bottom of a large wooden bowl into the vessels that are destined for its reception." It has been observed, that "but few experiments have hitherto been made with the view of deciding the most advantageous method of disposing the milk for the purpose of raising the cream in the largest proportion, and the shortest space of time: however, as the oily or butyraceous part of milk would seem to be diffused through the whole substance of the milk, and entangled among its particles, betwixt those of the serous and caseous kind, so as to be thrown up only in consequence of its possessing less specific gravity than the portion which is usually termed milk, from its becoming in a state of rest; it would seem that the most suitable method of placing it for the purpose of creaming well, and in the most expeditious manner, is that of very shallow pans, leads or trays, so as that it may not stand deeper than three or four inches at the most; as in this way there will not only be the least resistance afforded, but the greatest possible extent of surface for it to collect upon: by which means a larger proportion of cream is not only produced, but it is found from experience in the best dairy districts, that in consequence of the more expeditious cooling of the milk, the tendency to acidity in warm seasons is considerably checked and retarded. No trials have been instituted so as to decide what sort of material is the most appropriate and conducive to this end: it is probable, however, that wood or stone is much better than lead, as being not only more easily kept clean and sweet, in consequence of their being less disposed to fur, but from their being more safe, on account of their not being acted upon by the acid of the milk." And this, it is supposed, "is in some measure proved to be the most adviseable practice, from its being almost generally adopted in the best dairy-management." In this sort of business "there is likewise another point on which further experiments are wanting, which is that of ascertaining the degrees of heat in which the different changes may take place with the greatest certainty and success at different seasons:" those in which the operations seem to proceed in the most regular manner will be seen below, when we come to speak of the temperature proper for the dairy-house. There is not less uncertainty in respect to "the length of time that the milk should remain in the pans or trays, in order to afford the cream in the largest quantity before it is separated. Some suppose that this should depend upon the particular views of the dairy-man, and the degree of heat that is present at the period."

Doctor Anderson observes, that "in a moderately warm temperature of the air, if very fine butter be intended, it should not be allowed to stand more than six or eight hours. For ordinary good butter,

it may safely be let stand twelve hours or more; but where the dairy is so large as to afford a sufficient quantity of cream, and where the very best butter is intended (the milk being to be converted to some other use while yet sweet), it may be separated after standing only two, three, or four hours. In the general management of dairies, milk is never skimmed more than once; but in the county of Essex, as well as some others, it is the common practice to skim it three or four times, or till no more cream rise. In the business of separating the cream from the milk, there are two methods pursued; that most generally practised is to skim it off with a skimming-dish, made either of tin or of wood. The other is adopted only where leads or cisterns are common, and where the milk is used for making skim-milk, or two-meal cheeses; and, of course, before it coagulate, or acquire any degree of acidity. Towards the centre of the cistern there is a hole or pipe, which, before the milk be put in, is shut with a wooden stopper that rises several inches above the surface of the milk. When the milk is wanted for any of the purposes above mentioned, a vessel is placed under the pipe, and the stopper drawn up so far as to allow the milk to run off, but so gently, as that the surface of the cream may not be broken. The milk being thus gradually drained off, the cream sinks down, till it at last rests on the cistern: when the vessel containing the milk being removed, and another placed for the purpose of receiving the cream, the stopper is entirely drawn out, and the cream drops into the vessel. The first of these methods requires a dexterity of manipulation that can be acquired by practice alone: but it is of great importance to the success of the dairy that it be well done; for, if any part of the cream be left, the quantity of butter will be diminished; and if any part of the milk be taken, its quality will be debased;" and of course the article rendered much less valuable.

After the cream has been separated from the milk in the above manner, it should be immediately put into a proper vessel by itself, to be kept till a proper quantity has been collected for being made into butter. See *Butter*.

But where cheese is the produce to be obtained, the milk is frequently made use of without being deposited in any sort of vessel of this nature, being put, as soon as brought from the cow, through the sieve into the cheese-tub, to be converted into curd. See *Cheese*.

In regard to practice of dairying in different districts, various observations have been thrown out by different writers. In the Rural Economy of the Midland Counties, Mr. Marshall remarks, that the size of dairies has of course increased with that of farms. A hundred cows are, nevertheless, considered as a very large dairy: there are few so large. Forty or fifty cows are considered as a dairy above the middle size. The species of cow here, as in other places, is indeterminate. Glocestershire, north-country, and a mongrel breed between the two. Five years ago it was said that the north-country cows were losing ground, and that the old stock were coming again into esteem. He remembers the observation of an experienced dairy-woman in 1783 was, that the north-country cows neither milk so well nor fat so well as the true dark-brown Glocestershire breed. Nevertheless, he says, he cannot perceive that they have made any progress. On the contrary, the long-horned breed appear to have increased since that time. A man whose knowledge of the rural affairs of this district, and of the several breeds of cattle of this quarter of the island, is, he says, extensive, and whose remarks are seldom superficial, sees this recent increase of the northern breed of cows in a point of view which seems to have escaped the observation of others. He is of opinion, that it has been effected by other circumstances than the comparative merits of the two breeds of cows; which, he thinks, has had little or no influence in the change that has been taking place. He attributes it to the advanced price of dairy produce, during a succession of years last past. The dairy being found, in this well-soiled dairy country, to pay better than breeding; this of course declined: and, as the young stock diminished, the quantity of vacant pasture increased: consequently an increase of alien cows became doubly requisite. This increase was not to be obtained from the Glocestershire breed; nor could the supply be drawn from the kindred breeds of the neighbouring districts; nor perhaps from any other source than that from which it has been principally drawn: namely, the north of Staffordshire; where breeding is the principal object, and where the produce of the dairy is of much less value than it is in the vales of Glocestershire. Certain it is, that on farms whose grounds by soil and situation are wholly adapted to the dairy, we see the greatest proportion of north-country cows; while on those which have rough or distant grounds belonging to them, adapted to breeding, the Glocestershire cows still hold possession; and, by those who have them, are still in the highest esteem. Impressed with these ideas, the ingenious author of these remarks, he says, is of opinion, that should the dairy continue for a length of years in its present declining state, especially if breeding should continue to pay so well as it has lately done, the influx of alien cows will be stopped; their prices will no longer be a temptation to the dealers, and their places in the pasture will be occupied by rearing stock—not of the north-country, but of the Glocestershire breed. Be this as it may, it is, Mr. Marshall believes, a well-known fact, that the cheese of this district has been falling off, in point of superior excellency, since about the time of the introduction of the north-country cows; and an advocate for the Glocestershire breed would of course argue, that the north-country cows are unfriendly to cheese. On the contrary, however, it is asserted, by those who are the best authority in this case (the cheese-factors), that there are dairies consisting wholly of north-country cows, which make cheese of the first quality;—while the advocates for the breed assert, that their milk not only makes cheese of a good quality, but that it affords a greater proportion of

curd than that of the Gloucestershire breed. Upon the whole, therefore, we have sufficient evidence, he thinks, to conclude, that the superior excellency of the Berkeley cheese is not, nor ever was, owing to the species of cow.

In the choice of cows, dairy-farmers in these parts are guided by different criterions. The Derbyshire cow remains the favourite of the old dairiers. They argue, he says, that the grazier and the dairy-man, distinctly considered, require different animals to suit their respective purposes. The dairier's object is milk; the grazier's beef; and it is a trite remark among dairy-men in different districts, that a cow which runs to beef is unprofitable to the dairy: for notwithstanding the excellency of her bag, and the plentifulness of her milk, presently after calving, her natural inclination to fleshiness draws off her milk: while a cow that is by breed, or natural constitution, prone to milk, will supply this, at the expense of her carcase, let her pasture be ever so plentiful. These popular opinions, however, though they contain much truth, are not altogether, he observes, well founded. They hinge on a false principle. Cows are useful, and in a great degree necessary, in a two-fold capacity: as dairy-cows, and as grazing stock: the dairy-man and the grazier cannot have distinct animals: one and the same individual must serve both their purposes. And a breed of cows fit for the grazier only, is, in a general light, not less eligible than a breed which is fit only for the dairy-man. The Derbyshire cows are unprofitable as grazing stock. They have neither beauty nor utility of form; being loaded with offal of every kind. The head thick, the chap and neck foul, the bone proportionably large, the hide heavy, and the hair long; even the bag is not unfrequently so overgrown, as to be almost hid in hair; a point of milking cows to which dairy-women, of most districts, have an objection: this, however, only serves to show that popular criterions are seldom to be depended upon. Were the flesh and fatting quality of the Derbyshire cows equal to their quality as dairy-cows, the hairiness of their bags might be well dispensed with. The Staffordshire cows bear a different characteristic. Taking them together, they are rather adapted to grazing than the dairy; most of them being tolerably clean. But, in general, they are too gaunt in their carcases to be eligible, either as dairy or grazing stock. Nevertheless, there are individuals of this breed, or rather, perhaps, of a breed between this and the Derbyshire, that may be said to be at once eligible as dairy-cows and grazing stock. At least, they come nearer his idea of what a cow ought to be, than any other breed or variety of the long-horned breed he has yet had an opportunity of observing. The principal distinction observable between the form of what is here spoken of as a dairy-cow and that of a cow of the modern breed, or what is more generally understood by a good grazier's cow, is, the former is more roomy and better let down in the chest; the latter, better topped, fuller on the chine and loin, and, generally, fuller in the thigh. Both of them are clean in the fore-end and shoulder; the bone in both is fine; the flesh of both good (but that of the modern breed indisputably better); and their hides of a middle thickness. But the most material difference, and that which determines the dairy-man in his choice, is, the one loses her milk a few months after calving; the other, if required, will milk the year round. See *Cattle*.

In the summer management of dairy cows, in these districts, they are turned to grass about May-day, allowing from an acre and a half to two acres to a cow; kept generally in one and the same pasture, until aftergrass be ready to receive them; and have turnips thrown to them (by those who grow turnips) on grass-land, in autumn. One instance of practice occurred to him which requires to be registered: namely, that of a dairy of fourteen or fifteen cows being principally dried off together, on one day (the middle of December); preserving two or three only in milk for the family during the winter months; keeping these at hay; putting the dried cows to straw; for which purpose only they were dried off in this remarkable manner. It is observable, however, he says, that this practice can be eligible only when cows come well together: to effect which they are bulled as fast, that is to say, as near together as possible. Unnatural as this expedient will no doubt be deemed by many, it may, nevertheless, he thinks, in some cases, be eligible: and he observed it in the practice of one of the oldest and best managers in the district. In the winter management of dairy-cows, one circumstance may, he says, be noticed; that of their being frequently kept (in conformity to a modern practice adopted by some leading men) in sheds, which have been described under the head Buildings, continually throughout winter, from the time of their being taken up in autumn, to that of their being turned to grass in the spring, generally four months, without any exercise. Some discerning individuals, however, have already discovered the inconveniences of this practice, especially that of their hoofs cracking; let them loose in a yard, a few hours every day, to moisten their feet, as well as to exercise their legs, and clean their coats. In what might be called the natural practice of the district, dairy-farmers not only rear but fat their own cows. One of the largest farmers in the district told him, that he never bought a cow in his life; he rears fifteen, eighteen, or twenty calves yearly, and fats his own stock; or, for want of room, sells them to graziers. 'This, says Mr. Marshall, forms a beautifully simple plan of management; well adapted to a middle-soil farm; and especially eligible for gentlemen, and others, who are deficient in judgment, and unacquainted with markets. The proportion of grass and arable being determined upon, and the quantity of stock ascertained, the machine is regulated, and nothing but a due attention to the number of heifers, annually reared, is wanted to keep it in continual and uniform motion. A certain number of dairy-cows, with a lot of fattening cattle, and another of young stock to follow them, in summer, and to eat straw

in winter. No going to market, but with corn, dairy produce, and cullen cows. A plan of general management, beautiful in theory; and, if one may judge from the comfortable independency which the person alluded to is possessed of, through a perseverance, by his father and himself, in this course of management, it is eligible in practice. See *Cow*.

In speaking of dairying in Warwickshire, he says, the only idea which he met with respecting milk and butter, is that of doing away the rancidness of turnip-butter, and the bitterness of barley-straw-butter, by a most simple and very rational means. Instead of putting the cream, immediately as it is skimmed off the milk, into the jar or other retaining vessel, it is first poured upon hot water, and, having stood till cool, is skimmed off the water; a new idea—but, he will venture to repeat, a most rational one; though he has not himself had an opportunity of proving it. In the same dairy in which the above expedient is used, a method of improving the quality of whey-butter is likewise practised. This improvement is effected by scalding each meal of cream, as it is taken off the whey, by hanging it over the fire until scalding hot, being careful not to let it boil. This too he registers as a simple and rational process, and not as one whose efficacy he has proved by his own experience. It is, however, on an authority which he has no reason to doubt.

It is remarked also, that, from the soils of the best dairy parts of this district, it would appear that a cool one is favourable to cheese. Nevertheless he says he received an idea, here, from a most experienced and intelligent manager, that a very cold wet soil is improper for the dairy: that is to say, a soil may be too cool for the purpose. The cheese it affords, though good in quality, is found deficient in quantity. His own farm being principally of that description of land, he has, during the latter part of his life, made rearing his principal object; considering his dairy merely as being subordinate to that end. He likewise registers the circumstance of cheese being, not unfrequently, made from new leys, even of the first or second year, while they consist chiefly of red-clover, with, perhaps, a mixture of ray-grass; yet, from these cultivated grasses, provided trefoil make no part of them, good cheese is made. A fact, he says, which dairy-farmers, in some districts, would not readily credit. See *Cheese*.

In considering the business of dairying in the Vale of Glocestershire, the same writer says, the management or immediate superintendance of a large dairy, especially one of which cheese is the principal object, is not a light concern. It requires much thought, and much labour. The whole of the former, and much of the latter, necessarily falls on the immediate superintendant; who, though she may have her assistants, sees, or ought to see, herself, to every stage of the business, and to perform the more difficult operations. This arduous department is generally undertaken by the mistress of the dairy; especially on middle-sized and small farms. In some cases, an experienced dairy-maid is the ostensible manager. There are three things principally requisite in the management of a dairy: Skill,—industry,—cleanliness. Without the first, the two latter may be used in vain; and a want of the last implies a deficiency in the other two. Cleanliness may indeed be considered as the first qualification of a dairy-woman; for without it she cannot have a fair claim to either skill or industry. With respect to cleanliness, the Glocestershire dairy-women, he thinks, stand unimpeachable. Judging from the dairies he has seen, they are much above par, in reality; though not so to common appearance. A cheese-dairy is a manufactory, a workshop, and is, in truth, a place of hard work. That studied outward neatness which is to be seen in the show-dairies of different districts, and may be in character where butter is the only object, would be superfluous in a cheese-dairy. If the room, the utensils, the dairy-woman, and her assistants, be sufficiently clean to give perfect sweetness to the produce, no matter for the colour, or the arrangement. The scouring-wisp gives an outward fairness, but is frequently an enemy to real cleanliness. The scalding-brush, only, can give the requisite sweetness: and he has seen it no where more diligently used than in Glocestershire. Cleanliness implies industry. A Glocestershire dairy-woman is hard at work from four o'clock in the morning until bed-time.

Which of the different branches of dairying is upon the whole most profitable, is, Mr. Donaldson observes, of little moment to have determined. Some of them can only be carried on with advantage where the situation of the farm is peculiarly favourable in regard to market; while the others (if the butter be salted, and become an article of commerce, as it generally does) may be established in any county in the island. Whether the branches of making butter, or cheese, when the dairies are under similar good management, returns most profit to the farmer, seems, upon the whole, a very doubtful point. The valuable part of the milk is in either case completely extracted; but although the produce sells at very different prices, the value, as has been seen above, is nearly the same; and, at Sir William Perry's calculation of the average quantity of a cow's milk by the year, makes the gross value of the milk of an ordinary cow, when managed in a proper manner, amount to 7*l.* 4*s.* per annum; a sum which, as a general medium, he says, from various calculations, he is satisfied, is neither greatly above nor below what ought to be stated as the produce.

Mr. Young says, that "Mr. Abdy, in his account of the Epping dairies, remarks, that their farmers buy pigs at four or five months old (which, in 1788, cost 18*s.* each), keep them on skimmed-milk for about a month, and sells them with 6*s.* profit. The general proportion, one to every three cows in milk; and as the cows (the long-horned Derby breed) in general stand to the pail for nine months, this will make three pigs fatted from the milk of each. The

average quantity of butter made by each cow, per week, is 4*lb.* of 16*oz.* and the whole, therefore, of each cow 156*lb.*

156*lb.* at 10*d.*	£.6	10	0	at 1*s.* 3*d.*	£.9	15	0
Calf,	-	0	18	0		1	5	0
Pigs,	-	0	18	0		1	10	0
	£.8	6	0		£.12	10	0"

Besides the particulars necessary to be attended to in the management of dairying, and which have been taken notice of in the course of the preceding detail, some others, in regard especially to the management of the cows, naturally fall, he says, under consideration. These, however, may be shortly stated. If, as there is every reason to believe, the cows that give the greatest quantity of milk are not always the most profitable for the dairy, it ought to become more the study of the dairy-man to purchase cows famous for the quality rather than the quantity of milk they yield. If the milk of a cow that gives six gallons in the day produce as much butter or cheese as that of another which gives eight, it is evident that the gross value is the same, while the fourth of the labour, a material article, is saved.

A very curious practice is stated by Mr. Best, to exist in the counties of Somerset and Devonshire, which is, that of the occupiers of large farms letting out milch cows to a dairy-man, from Candlemas, to Christmas, during which time, he has nothing to do with the land on which they depasture. Some allow twenty acres, others a little more, to summer fifteen or sixteen cows on, with one acre of aftermath to each in addition. At present they are let at from 10*l.* to 11*l.* per cow, from which it is evident, much profit arises with little trouble or expense.

Dairy-*Farm*, that sort of farm which consists principally of meadow and grass-lands, and the profits of which chiefly depend upon the dairy. Farms of this kind are in general more advantageous than those of the corn or arable kind, especially those of the smaller sort. See *Arable Farm.*

Dairy-*House*, a building constructed for the particular business and purposes of the dairy. In houses of this sort some variation will be necessary, according as they are butter, cheese, or milk-dairies. A well-constructed butter-dairy should consist of three apartments; a milk-house, a churning-house, with proper boiler, as well as other conveniences for scalding and washing the implements, and a room for keeping them in, and for drying and airing them, when the weather will not permit of its being done without doors. And the cheese-dairy should likewise consist of three apartments; a milk-house, a scalding and pressing-house, and a salting-house. To these should be added a cheese-room or loft, which may with great propriety be made above the dairy. This is, however, generally separate from the dairy. But a milk-dairy requires only a good milk-house, and a room for scalding, cleaning, and airing the utensils.

It is observed by Dr. Anderson, that no dairy can be managed with profit, unless a place properly adapted for keeping the milk, and for carrying on the different operations of the dairy, be first provided. The necessary requisites, says he, of a good milk-house are, that it be cool in summer, and warm in winter, so as to preserve a temperature nearly the same throughout the whole year; and that it be dry, so as to admit of being kept clean and sweet at all times. For these reasons a northern exposure is the best, and this as much under the shade of trees or buildings as possible; if it can be so situated that the sun can have no influence either on the roof or walls, so much the better.

As it is on most occasions difficult to contrive a place within the dwelling-house that can possess all these requisites, he advises that a separate building should always be erected, which, upon the plan he describes, may in every situation be reared at a very small expense, and will answer the purpose, he thinks, much better than any of those expensive structures he has seen, that were built by noblemen or gentlemen for this use.

This structure ought, says he, if possible, to be erected near to a cool spring, or running water, where easy access can be had to it by the cows, and where it is not liable to be incommoded by stagnant water. It should consist of a range of narrow buildings, as in the plan; *fig.* 1, *pl.* XXI. that division in the middle, marked *a*, being the milk-house properly so called. The walls of this building should be reared of brick, or of stone and lime, all round the inside; this wall need not exceed in thickness one brick in length, or, if of stone, about one foot thick; beyond that, the wall, which is full six feet in thickness, should be made of sod on the outside, and earth rammed firm within that. The inside wall of this building may be seven or eight feet high in the sides, on which may be placed the couples to support the roof, and the walls at the gabels carried up to the height of the couples. Upon these should be laid a roof of reeds, or thatch, that should not be less than three feet in thickness, which should be produced downward till it covers the whole of the walls on each side: but here, if thatch or reeds be not in such plenty as could be wished, there is no occasion for laying it quite so thick. In the roof, exactly above the middle of the building, should be placed a wooden pipe of a sufficient length to rise a foot above the roof, to serve occasionally as a ventilator. The top of this funnel should be covered, to prevent rain from getting through it, and a valve fitted to it, that by means of a string could be opened or shut at pleasure. A window also should be made upon one side for giving light, the structure of which will be best understood from the section of this part of the building, which is represented at *fig.* 2. by *f, g.* It is necessary to specify, however, that this aperture should be closed by means of two glazed frames, one on the outside at *g*, and the other on the inside at *f.* It is hardly necessary, he thinks, to inform the reader, that the use of this double sash, as

well as the great thickness of the wall, and of the thatch upon the roof, as also of the buildings at the end of it, are to render the temperature of this apartment as equal as possible at all seasons of the year, by effectually cutting it off from having any direct communication with the external air.

The apartment marked *b* is intended to serve as a repository for the utensils of the dairy, and a place in which they may be cleaned, and put in order, to be ready when they are wanted. For this purpose ranges of shelves may be placed all round the walls, and tables and other conveniences placed where necessary. Here the walls are thinner than the other, and may be built wholly of brick or stone, nor is there a necessity for having the thatch here so thickly laid on as in the middle division. In one corner, at *h*, is placed a cauldron of a convenient size proportioned to the dairy, for warming water to scald the vessels, over a close furnace, the flue of which terminates in a chimney carried slanting over the door in the gabel, above which it rises upright, and there emits the smoke.

The other apartment, *c*, may be employed as a kind of store-room, in which the cured butter, and other products of the dairy, and spare utensils, may be locked up, till it becomes convenient to transport them elsewhere. He likewise supposes, that if the dairy be situated so near a town as that ice could be disposed of with profit in summer, it might be very useful to convert this apartment into an ice-house, which would be on many occasions a very convenient appendage of the dairy. All that would be necessary in this case, would be to build the walls in the same manner, and make them of the same thickness, with those of the apartment *A*, as marked by the dotted lines, *i*, *k*, *l*, *m*: the thatch being also laid on to the same thickness. If this were intended, firm posts of wood ought to be placed in the floor, as marked in the plan, *n*, *o*, *p*, *q*, so as to form an inner square, with an open walk all round of two feet in breadth. Within these posts should be placed hurdles of a convenient shape, formed of wicker-work; the wands of which they are made having been all peeled, and previously dipped in warm coal tar, to preserve them from rotting. Within this square, is the receptacle for the ice. The ice-house to be filled by opening the double doors at *K*, *L*, which should then be closed, not to be opened till it was again to be filled, and the aperture between them to be filled with straw rammed firm, to prevent the admission of air by that means. The ice to be taken out occasionally, as it may be wanted, through the milk-house. Many, says he, would be the conveniences the dairy would derive from this accommodation, and small the expense. By means of it, the products of the dairy could be always cooled to the degree in summer that should be found to give them their greatest perfection. Other advantages, he says, might occasionally be derived by the attentive farmer from this easily obtained accommodation.

Where cheese is the principle object of the dairy, another additional room, somewhat differently constructed, would be wanted, for the purposes of pressing and salting the cheese.

The smaller apartments, *R* and *S*, are merely cavities formed in the thickness of the partition-wall, that may be employed for any use that shall be found convenient, the double doors on these passages being intended merely to cut off more effectually all communication between the external air and the milk-house, when either the great heat or great cold of that may render it necessary. The thatch above these small apartments ought to come one foot lower within than in the milk-house, the more effectually to bar all communication of air from the outer apartments, at the place where the couples are placed. When the air is temperate, the door at *T* may in general be left open to facilitate the entry to and from the milk-house on ordinary occasions. All the doors open as marked by the dotted lines. Through each of these doors, as well as the outer doors of the apartments *B* and *C*, ought to be made an aperture of about a foot square, having a small door exactly fitted to it, that can be opened and shut at pleasure. Over the inside of each of these apertures should be stretched a piece of fine gauze covered with a fine netting of wire, so that when the air is temperate, and the wind blows in a proper direction, by opening these little doors, a draught of air may be carried through the whole of these buildings that will keep them sweet and dry, without admitting flies or other vermin. The whole of these apartments should be neatly plaistered with lime on the inside of the walls and ceiling. The apartment *a* at least should also be paved with flat stones, that should be raised six inches higher than the surface of the ground without, having slanting gutters readily to convey water or any other liquid that might be accidentally spilled there; but he observes, that it is a slovenly dairy-maid who slabbers her floor. The walls all round should be lined with shelves of a convenient breadth, in ranges one above the other, on which the dishes may be placed; and in the middle should stand a large table, marked by the dotted lines on the plan, which, if made of stone, will be found to be more cleanly and convenient than any other material. Beneath it a piece of the pavement, about a foot in breadth, should be raised six inches higher all round than the level of the floor, so as to form a trough within it for holding water, the uses of which will be afterwards specified. This bason may be emptied entirely at pleasure, by opening a hole that allows the water to run into the common gutters. The intention of all these contrivances, it will easily appear, is merely to enable the attentive owner of a dairy to keep his milk in a proper degree of temperature, both during the summer and the winter-season, without much trouble or expense to himself; as any considerable variation in the degree of heat tends greatly to derange his operations, and to diminish the value of the products of the dairy. If the heat be too great, the milk suddenly coagulates, without admitting of any separation of the cream, and it is so suddenly rendered sour as greatly to marr

every operation. If, on the other hand, the milk be kept in too cold a temperature, the cream separates from it slowly and with difficulty, it acquires a bitter and disagreeable taste, the butter can scarcely be made to come at all, and when it is obtained is so pale in the colour, so small in quantity, so poor to the taste, hard and brittle of consistence, and of so little value in every respect, as to bring a very low price at the market, compared to what it would have produced had it been preserved in a proper degree of warmth. To avoid, therefore, as much as possible, both these extremes, the milk-house, properly so called, is here placed in the center of the building, into which there is no access directly from the open air; nor even from the porch, but through a double door, one of which ought always to be shut before the other be opened, when either the heat or the cold of the weather is excessive, though at other times this precaution may be omitted. The walls of this part of the building are made of earth so thick, and the roof of thatch so thick also, as directed, because it is found these substances transmit heat or cold with less facility than any others that can easily be had, so that a very long continuance either of hot or cold weather would have no sensible effect in altering the temperature of this chamber; and if it should at any time acquire a small degree of heat or cold more than was desirable, and this were corrected by artificial means, it would retain that artificial temperature for a long time. These are the advantages proposed to be derived from this simple mode of construction.

Experiments have not yet, he remarks, been made to ascertain what is the precise degree of heat that is the most favourable for the different operations of the dairy. From the trials he has made he has reason however to believe, that when the heat is from 50 to 55 degrees on Fahrenheit's thermometer, the separation of the cream from milk, which is the most important operation of the dairy, goes forward with the greatest regularity. He is therefore inclined to think that this will be found to be the temperature that ought to be aimed at in the dairy: but he does not here pretend to decide with a dogmatic precision; a considerable degree of latitude in this respect may perhaps be allowable: but from the best observations he has been able to make, it seems to him highly probable, that when the heat exceeds 60 degrees, the operations become difficult and dangerous; and when it falls below the 40th degree, they can scarcely be carried forward with any degree of œconomy or propriety. Till farther experiments, therefore, shall ascertain this point, says he, we may take it as a safe rule, that the heat should be kept up, if possible, between the 50th and 55th degree; and to ascertain this point, a thermometer, graduated by Fahrenheit's scale, should be hung up perpetually in the milk-house, to give notice to the owner of any alterations in the temperature that may affect his interest. Luckily it happens that this is very nearly about the average temperature that a building, so well secured as this is from the external air, would naturally bear at all seasons of the year in this climate, were it not to be affected by external objects. But as the heat of the milk, if it were in considerable quantities, would tend in summer to affect the temperature of the air, there is no impossibility but it might thus be raised on some occasions to a higher degree than was proper. It is to have at all times at hand an easy cure for this disorder, that he wishes to call in the assistance of the ice-house; as a small quantity of ice, brought into the milk-house at any time, will quickly moderate the heat to a proper degree. In the two small chambers adjoining to the ice-house too, or in the passages around the ice-house, the butter may be kept even cooler than in the milk-house itself. Other advantages that would arise from this small additional building will appear obvious.

In winter, should the cold ever become too great, it might, he thinks, be occasionally dispelled, either by placing a barrel full of hot water, close bunged up, upon the table, where it may be allowed to remain till it cools, or some hot bricks might be employed for the purpose. This he prefers to any kind of chaffing-dish with burning embers in it, as the vapour from the coals which very soon affects the taste of the milk, would thus be avoided.

Fig. 3 is a representation of another form of dairy. A the milk-house; *aaa* the coolers; *b* a slab for laying butter on after it is made up; *ccc* cocks for drawing off the milk from the coolers, one being made to serve two coolers, by a short piece of leaden-pipe from the holes *ooo*, which are stopped by a plug *p*, being made sufficiently long to extend above the surface of the milk; *d* a large cock to throw water on the floor, which slopes a little from that part; *eee* are also cocks at the back part of the coolers, for letting in water; *f* is a door, latticed as in *fig.* 4; *g* is another door most commonly used, but pannelled. B is the churning-room; *h* a fire-place; *k* a boiler; *l* a large copper, used when brewing. C room for drying or airing the utensils, also used occasionally as a laundry. Over these are apartments for the servants. *Fig.* 5 is a view of the inside of the dairy at the end Q. This is the kind of dairy-house made use of by the ingenious Mr. Wakefield, near Liverpool. The size of the dairy-house should vary according to that of the number of cows. Mr. Marshall found in Gloucestershire one for forty cows to be twenty feet by sixteen, and one for one hundred, thirty by forty. The North-Wiltshire dairy-rooms have in general, he says, outer doors, frequently opening under a pent-house or open lean-to shed; which is a good conveniency, affording shade and shelter, and giving a degree of coolness to the dairy-room. In one instance he observed two doors: a common close-boarded door on the inside; and an open-paled gate-like door on the outside; giving a free admission of air, in close warm weather; and, at the same time, being a guard against dogs and poultry: A conveniency which, he thinks, would be an improvement to any dairy-room in the summer-season.

Dairy-*Husbandry*, that kind of husbandry which relates chiefly to the management of the dairy.

This kind of husbandry, in its different branches, Mr. Donaldson observes, is more or less established in every county in Great Britain: but that few of them can boast of having arrived at any excellence in the art. Gloucestershire, Cheshire, Wiltshire, and a few others in England, and Ayrshire in Scotland, stand first in the list of cheese-making districts; while Essex, Cambridge, and Suffolk, are equally celebrated not only for the quality but the quantity of butter that is thence exported to London and other markets. In some parts of England, the breeding and rearing of live-stock occupy to a great degree the attention of farmers; while, in others, the pastures are chiefly devoted to the fattening of cattle and sheep. In Scotland, with the exception above-mentioned, dairy-husbandry is certainly in its infancy. In managing a dairy, several circumstances merit attention. The dairy-house should be so large, in proportion to the number of cows to be kept, that there may be sufficient convenience for performing all the necessary operations without embarrassment. Much attention must be paid to cleanliness in every thing that relates to it, such as the different implements which are made use of—as without due regard in these respects it is impossible that the produce of a dairy, whether of butter or of cheese, can be of superior quality, or such as will keep sweet and good for any length of time. Cleanliness may indeed be said not only to be necessary in dairy-husbandry, but to be the foundation, the most essential and least indispensable part, of good management. A farmer may be in possession of the most valuable breed of cows, and these be fed on the richest pastures; but unless cleanliness prevail in the dairy, his butter or his cheese will never stand high in general estimation. Next to the size and situation of the dairy-house, and to keeping it and the utensils clean, skill and attention in the general management are equally necessary. Whoever has attended to the operations carried on in a well-conducted dairy, even for a short time, must, he says, have been satisfied that skill was as requisite in the person who directed, as attention and alertness in those who executed them. In short, it must have appeared obvious, that without a knowledge of the best modes proper to be adopted under different circumstances, and a regularity, method, and prompt attention to their execution, business of this kind must soon go into the utmost confusion.

Dairy-*Maid*, the woman who has the management of a dairy. They should be perfectly steady and well conversant with the various processes that are necessary to be employed.

Dairy-*Man*, a term frequently applied to such farmers as have dairy-farms, or are engaged extensively in that sort of business.

Dairy-*Utensils*, all such kinds of implements as are employed in the operations of the dairy. These, Dr. Anderson observes, in general must, from the nature of the business, be made of wood. But of late many persons, who affect a superior degree of elegance and neatness, have employed vessels made of lead, or of common earthen-ware, for various purposes in the dairy. But, says he, as the acid of milk very readily dissolves lead, brass, or copper, and with these forms a compound of a poisonous nature, such vessels must be accounted highly pernicious in the dairy, and therefore ought to be banished from it. The same may be said of vessels of any of the common kinds of earthen-ware, which being glazed with lead, and the glazing soluble in acid, are equally improper. Mr. Hayes has, he says, recommended cast-iron as a proper substitute for these; but this metal also is soluble in acids; and though the solution be not poisonous like the others, yet, as it may affect the taste of the products of the dairy, and render their qualities different from what they would naturally have been, the use of these also should be laid aside. In short, excepting vessels of true porcelain, or glass, which are greatly too expensive, he knows of none that could be with propriety substituted for wooden vessels in the dairy. China or glass vessels, however, for obvious reasons, can never come into general use in the dairy; nor will the sensible husbandman ever think of any other than wooden dishes for his milk; as these, if properly managed, can be kept as sweet and pure as the imagination can conceive. This fact is so generally known as to render wooden dairy-utensils common in most parts of the country, so as that they can be readily procured every where of a proper quality and form of construction. Common flag-slate is used for the purpose of milk-coolers in Leicestershire; and other kinds of slate might probably be employed with still greater advantage.

There are various sorts of utensils required in the dairy, such as skeels or creaming-dishes, milk-pails, milk-cowls or coolers, and milk-strainers or sieves, cheese-ladders, lading-dishes, skimming-dishes, churns, cheese-presses, cheese-vats, &c. See *these different Articles.*

DAIRIER, a word applied to a person who keeps a dairy, or a dairy-man.

DAISY is the name of a perennial weed common in pastures. The leaves are jagged, and embrace the stalk. The flowers are large and radiated. The ray is white, and the disk yellow: the seeds have no down. It has sometimes the name of ox-eye, but by some is called maudlin-wort.

DAITLE, a term provincially signifying any thing done by the day.

Daitle-*Man*, a day-labourer.

Daitle-*Work*, such work as is done by the day.

DALLOP, a provincial term, which signifies a tuft or clump of grass, &c.

DAM, the mother of any young domestic animal.

Dam, a mole or bank to confine water. See *Embankment.*

DAMSON, a small useful black plum, brought originally from Damascus; whence the name.

DANDELION, the name of a very troublesome and well-known weed in meadows and other grounds,

and which will spread greatly if the flowers be suffered to perfect their seeds, which are light, downy, and of course easily blown about by the wind.

DANEWORT, a term applied in some counties to that species of elder generally called dwarf-elder, or wall-wort.

DANK, a term made use of to signify damp, humid, moist, wet.

DANNOCKS, a provincial word, applied to hedging-gloves.

DAPPLE, a term used to signify marked with various colours. See *Colour*.

DARGUE, a term signifying the quantity of peats one man can cast, and two wheel, in a day.

DARNEL, a troublesome weed in wheat-crops. See *Wheat*.

Annual Darnel-Grass, a kind of grass called by some white darnel, and in the southern counties crap. It is so much like the red darnel-grass, that it has been much cultivated under the name of ray-grass, or vulgarly rye-grass; but the spike is much longer and paler, and has beards, which the ray-grass is entirely without. It is likewise annual; whereas the ray-grass has an abiding root. Its seeds ripen with the corn. See *Lolium perenne*.

DARTARS, in *farriery*, a sort of scab or ulceration taking place on the chin, to which lambs are subject, and which, if not removed, is apt to extend to the mouth, and prove fatal. It has been said to be removed by washing the sores with vinegar, and applying a salve composed of equal parts of tar and hogs-lard.

DAUBING, a word signifying plastering with clay.

DAUBY, a word applied to land when wet, signifying clammy or sticky.

DAVYING, a provincial word applied to the getting of marl out of the face of the cliffs on the sea-coasts, when it is drawn up by a wince.

DAY-*Break*, a term applied by farmers to the dawn, or the first appearance of light.

Day-*Labourer*, a labourer who works by the day.

Day-*Work*, such work as is performed by the day.

DEAF, a word signifying blasted or barren, as a deaf ear of grain, a deaf-nut, &c. or such as have no grain or kernel.

DEANETTLE, a term provincially applied to the weed wild-hemp.

DEARTH, a word signifying scarcity, or a time when food is dear.

DECEMBER, the last month of the year. This is a month when the labours of the farmer are somewhat less urgent, yet much is still to be carried forward in the round of his business. His attention must not now relax, in seeing that the live-stock in the farm-yards are daily supplied with proper food, and that these yards, as well as the stalls, stables, cow-houses, hog-sties, and all other places where animals are kept, be well littered down.

It has been well remarked by Mr. A. Young, that by "a little management, all the urine might be preserved: the drains that carry off the overflowings of the yard, should, he says, lead to a small well, with a pump fixed in it: this pump should have a light trough, turning on a pivot, to receive the liquid, and a heap of turf or marl be kept within reach of the trough: it should convey the liquid over the whole, which, being carted on to the land, would prove an excellent manure."

The following are the proportions of dung to straw consumed, as shown by the facts stated below by the same writer.

"Mr. Moody.—Forty-five fat oxen fattening, littered with twenty waggon-loads of stubble, raised 200 loads, each three tons, of rotten dung, worth 7*s.* 6*d.* a load." And "every load of hay and litter given to beasts fatting on oil-cake, yield seven loads of dung, each one ton and a half, exclusive of the weight of the cake."

It was found, "on a comparison between the oil-cake dung and common farm-yard dung, that twelve loads an acre of the former much exceeded twenty-four of the latter.

"Mr. Arbuthnot.—One hundred and thirty-four sheep and thirty lambs, penned six weeks in a standing-fold, and littered with five loads and forty trusses of straw, made twenty-eight large loads of dung. Fed morning and evening in the fold with turnips. Ate two acres of turnips.

Value, dung	- -	£.10	0	0
Straw, at 20*s.*	- -	5	15	0
Profit	-	£.4	5	0
Per acre for turnips	-	£.2	2	6
And per score per week	-	£.0	1	9½

"William White.—Thirty-six cows and four horses tied up, ate fifty tons of hay, and had twenty acres of straw for litter: they made 200 loads of dung, in rotten order for the land."

It is added, that "the experiments of Mr. Moody and Mr. Arbuthnot prove how well it answers to buy litter with a view to the dung: in feeding oxen with oil-cake, one load of straw makes seven of dung, each one ton and a half; and with feeding sheep with turnips, one trussed load made more than four and a half large loads, worth 7*s.* 6*d.* each. With Mr. White, twenty acres of straw, suppose thirty loads, made 200 of rotten dung in littering cows, which are six and a half for one: whence it appears, he thinks, that litter may safely be purchased at a very high price, rather than be without it. An argument which should be convincing with those who have it in their wheat-stubbles, and yet will not be at the trouble of chopping and carting it home" to their stack-yards.

The cattle under the fattening system should at this season be particularly attended to, to see that they have a full proportion of proper food given in a regular manner, and that they be kept sufficiently warm and clean. The swine must also now be duly

attended to, in order that the full profit may be derived from them, both in their being brought forward in the most perfect manner, and that the full quantity of manure be raised, by having them kept constantly well littered down.

As this is the middle of the season for fattening bullocks, hogs, &c. should any of the first sort be ready, if the best of them, they may find a good market, as large beasts are always in request against Christmas.

As it is found that old lays or swards cut easiest and best when the staple is soaked through with moisture, the latter part of the autumnal quarter is a very proper season for breaking them up. The breaking up such old meadows and pastures as are worn out, or become mossy, is a very profitable operation, and one which should never be withheld by a landlord from an intelligent and able tenant. It is an error to suppose that this practice is attended with immediate benefit to the tenant only, as, when performed under proper regulations, a lasting improvement is insured to the land. Old feeding-grounds, which have been neglected for a long series of years, until they become covered with mole-casts, ant-hills, or moss, and which produce only bad herbage, weeds, and trumpery; and mowing-grounds which are starved, hide-bound, matted at the roots, and tired out with the scythe; cannot be any otherwise effectually reclaimed, than by the loosening operation of the plough, and the consequent exposure of the under part of the soil to the influence of the atmosphere.

In these cases, perhaps, trench-ploughing is the most effectual method in the opinion of some; but in many cases the practice of paring and burning is far superior. In the first mode, the sod being buried by it, a bed of mould is left for any crop which may be put in: but this should constantly be a hoeing-crop, even when oats; or one great object in the change, that of a clean tilth, must be lost. It must be remembered, however, there is a very strong objection to the sowing a fresh crop over the buried net-work of roots of weeds and grasses, which, instead of rotting and turning to manure, according to expectation, may sometimes lie years in the soil, throwing up a constant and gradual produce of grass and rubbish: on this account, the operation of breaking up turf may often be incomplete, without burning the roots, as suggested above. It may be done, however, at any convenient time, even after taking a crop—peas, for instance—which being cleared off, the land may be dragged and couched, and the rubbish burned, in good time for sowing it with wheat; but this practice is far less beneficial than that of paring the surface, and consuming it by fire in the first instance. It is always a bad and loosing system to keep such old coarse worn-out over-run grass-lands in the state of pasture, as by breaking them up, and keeping them in a course of tillage for three or four years, and then restoring them to the state of sward again, four or five times the profit may be obtained that can be acquired by continuing it in the state of lay.

In threshing out the different crops, which may be conveniently done at this period, it may, according to some, be most prudent to begin at first of all with the best, for instance, the oat and barley-stover, which is most tender, and ought at least to be well mixed with clover, because the cattle have just come from succulent food. This sort of food being continued awhile, proceed by degrees to the wheat and bean-straw, having care so to manage as to be provided with plenty of the best provender for the last, the most difficult, and pinching part of the season. On a farm provided with proper and convenient stowage, the corn may be housed, or stacked, in such a manner as that any part or species of it that is most wanted may be immediately obtained.

With "many farmers, however, who keep large stocks of lean or dry cattle," an exactly contrary practice is adopted, they being "attentive to threshing out their *worst* straw *first*, and the *best last*, proceeding upon the same gradation through the winter, that every change of straw may be for the better. This, Mr. Young says, is a just conduct, and cannot fail of having good effects on the cattle, who, it is well known, often fall away in their looks on a change of straw that is the least for the worse. The wheat should, upon these principles, he thinks, be threshed first, as that makes the worst fodder; next the oats, then the barley, and lastly the barley or oats that had much clover mown with them; for, in wet seasons, the clover rises so high, that the straw is almost as good as hay." The advantages gained in this way to the straw-fed cattle are, he says, certainly very great; and it should be given to the cattle in a regular steady manner.

Mr. Marshall says, "he met with an idea that cattle may be satiated with straw; or, in other words, be served with it in too great plenty. It has been observed, that after a dry summer, when straw is scarce, and the cattle have it dealt out to them regularly, they do better than when, after a plentiful year, it is thrown before them in profusion from the threshing-floor; not through the superior quality of the straw in a scarce year, as these effects have been observed to be produced from the same straw. This subject is by no means uninteresting to those who winter large quantities of cattle; he has observed in Yorkshire, where cattle are kept tied up, and of course are regularly fed, that they in general do better at straw, than cattle in the south of England, where they go loose among a much greater plenty; but whether it proceed from the warmth, from their resting better, from the breed of cattle, or from their being regularly fed and eating with an appetite, he will not pretend to decide."

Mr. Young advises, that "the threshers be always chosen from the labourers with some care; as they should be honest, or the farmer will suffer much, if he does not watch them narrowly, as they have many opportunities of stealing and conveying corn away."

In this, as well as other points of view, a threshing-machine is an object of vast importance to the

tillage-farmer; and where the farm is extensive, indispensibly necessary. See *Threshing-Machine.*

In respect to the use of the team, a variety of necessary business may be found on which to employ it, in the early part of the month. The latter end being generally appropriated to rest, the necessary business of thorough inspection may be conveniently performed, and the accounts of the farmer fully made out.

The expense of keeping teams is however at present so great, that it is obvious that a great loss must be sustained if they are not kept constantly to close work: of course, at this as well as all other seasons, they should never be allowed to remain in a state of rest. In light dry soils they may now be employed in carrying out clay, chalk, or marl, where they can be found. And in many cases other sorts of manure may at this season be put upon the land, which will afford employment for them.

In the claying, chalking, and marling of lands, with the view of getting them into an improved state, the sooner the business is performed, the greater the advantage of the farmer; in these cases, therefore, they should constantly be kept to the work.

The manure may likewise in this month be taken out upon the hop-lands. And when the business of ploughing for spring-crops has not been capable of being performed, from particular circumstances, during the two preceding months, it should be accomplished in the first part of this; as to prevent spring-tillage on all wet lands is a matter of the greatest importance to the profits of the farmer.

Much care is necessary at this time to the sheep. The ewes with lamb require good nourishing keep, that they may be in heart to suckle their lambs; as there is not perhaps a more unprofitable practice than that of keeping breeding animals in a poor and low state, since, allowing the young to be brought forth of the full size, and in good health, of which there is great risk, the dams may fail of strength to support their growth, and very often even to bring them forth. Whatever course may be taken with the store-flock, neither the ewes nor the fattening sheep should be exposed to the storms, deep snows, and extreme cold of winter. They should have the benefit of some kind of shelter; as it is well known that good keep loses half its efficacy, unless aided by warmth.

Mr. Young advises, that "they should have plenty of turnips or cabbages, as fast as they lamb; for cattle that have young require as good keeping as those that are fatting; and if you let them have a rack of hay always in the field, it will be much the better for them. Draw the turnips or cabbages, and give them on a dry grass-field. One great advantage of cabbages over turnips, is the ease of cutting them, in case of the hardest frosts, when turnips cannot be had."

It is added, that "in case of extreme bad weather, it will be advisable to bring your sheep under shelter. Most farmers are sensible of this, and drive them on such occasions into their hay-stack yard, which is not a bad way; but much inferior to giving them their hay in racks, in a warm yard, with sheds around it for them to feed under. The use of such a yard is so great, that he wonders they are not more common. In driving snows, sleet, and rain, the injury sheep take in the open field is, he says, very great."

And another circumstance, which he suggests as of great weight, is that of raising large supplies of rich manure. "By keeping the sheep in very bad weather all day, and constantly of nights, in a yard proportioned to their number, you fold them, he says, perhaps, in the most advantageous method of all others; for if a layer of turf or marl be spread over the bottom of the yard in autumn, and under all the sheds, and the sheep are kept well littered with straw, fern, or stubble, so as to be always perfectly clean and dry, they will in the winter make a great quantity of excellent manure."

Hedging and Ditching are employments proper for this season; and they afford support to those labourers, without whose constant and regular assistance the business of husbandry cannot be carried on; and by being thus attended to, the fences on the farm will be, in a short time, in the most perfect state. Mr. Young advises to get the fences of a farm into good order in the three first winters of the lease; and afterwards to divide them into twelve parts, and to do one every year, which will bring the whole to regular cuttings; which is certainly a very judicious mode of proceeding.

In the manuring of grass-land, it must depend upon the season whether it can be done at this period or not. It is best to be finished before the frost, that there may be a chance for it to get beneath the surface, and be prevented from being washed away by the heavy rains. On those fallows which have not been dressed, frosty weather affords a good opportunity for carting dung upon the land, where it may be left in heaps until the spring-tillage; for dung ought never to be left for any length of time spread upon the surface, either in winter or summer, since much of its virtue is in that state dissipated and lost to the land; nor is there any other use than saving time in this winter-cartage of dung to be left on the surface of fallows. In some cases it may, however, employ the horses, which would otherwise be idle, and a great loss to the farmer.

The business of the dairy must likewise at this season be attended to, as the making of cheese in some cases goes on through the winter.

Mr. Young advises, that where the farmer has a small piece of experiment-ground, which is often useful in trying different sorts of seeds or plants before they are employed on a large scale, that at this leisure season he should mark out the field for the various purposes of experiment, fixing upon land that is not much better than the rest of the farm. See *Experiment-Ground.*

At this period the farmer should likewise take care that the wood-men continue their work. See *Woods.*

The poultry-yard will likewise require attention

at this season, as they will now be on full sale. The houses should be kept as clean and free from dirt as possible, as by that means the fowls will be much less subject to disease.

This is the season when the accounts of the farm should be brought into order, for their being in some degree closed, and the balances struck.

It has been well remarked by Mr. Young, that "there is not a single step in the life of a farmer that does not prove the advantage of his keeping regular accounts; and yet, continues he, there is not one in a thousand who does this. This is among the many instances, he thinks, in which the unenlightened situation of the practisers of the art is the evident reason for the backwardness in which the art itself is found by any man who searches for the principles deduced from practice, which ought to give it the regularity of a cultivated science. A few rough memoranda, or figures, to yield a gross account of the general receipt or payment, are usually the greatest exertions that common farmers, who pretend to keep accounts, make in this line."

It is justly added, that "the advantages of clear accounts are obvious in every other pursuit in life; and to conduct those of a merchant by the Italian method of double entry, has been made an essential branch of education for the classes intended for commerce. Men engaged in large speculations, who are not regular in their accounts, are always supposed by the prudent part of the world to be in a dangerous situation; nor is there a greater reproach to a merchant, short of actual bankruptcy. But agriculture, says he, is destined to be, in all its detail, an exception to every thing else. Men engage in it without previous education, or even study and inquiry, and they conduct large concerns in it without those accounts known to be necessary in every other pursuit. With the lowest and most uneducated farmers, this is pardonable; but what excuse have gentlemen for such a conduct? It should, he says, be remembered, that experimental agriculture, or even those ideas more or less detailed, which we meet with in conversation, must depend for their justness very much on the accuracy of accounts; for a supposition deduced from general observation on a farm, and grossly conceived, must fall exceedingly short for correctness, of the regular detail of exact accounts."

It is added, that it unfortunately happen that these accounts "are usually kept in such a manner as to prove rather the means of fortifying prejudices, than removing errors; all those questions of nicety, where the contrasts are not exceedingly strong, relative to the comparative profit of different soils, of different courses, of different applications of the same soil, of different modes of culture, &c. depend on accounts. Keep your accounts in the mode of one man, says he, grass is more profitable than tillage; keep them in a different method, and the contrary shall be the result. The variety in the mode of keeping these accounts is very great, even among gentlemen of considerable attention, carefulness, and accuracy." And "this comes, he thinks, from the great and undoubted difficulties which rise in many forms, whenever an attempt is made at positive accuracy. They are not imaginary, but real difficulties, and such as will demand a considerable attention to obviate. He has reflected on the subject for many years, and they are few in which he has been satisfied with any approach towards accuracy. For while there are distinctions which must every where be kept up, there are many minutiæ that must be sacrificed, in order to render the account tolerably easy to keep, without an attention that a man in an active line of life cannot give. To keep to this medium is, he thinks, the great difficulty" of the business.

In his opinion, "the nature of the farm must, in some instances, regulate the mode of the accounts. Suppose, says he, a man has the evil of an open field one, with scraps and bits of land scattered amongst his neighbours: in such a case it is impossible for him to keep an account for every field; and yet this is one of the most indispensable points that in general must be adhered to; for he who does not know what every field has paid him, is deficient in the very foundation of experience. In this light, all little fields on a large farm are nuisances: they derange accounts entirely, if the greatest attention be not paid, and they are as inconvenient in cultivation, and attended with as much loss in headlands, and borders, as they are ruinous to any exactness of account. But as many persons keep accounts without attending to this point, he would observe, that when all the wheat, all the barley, all the oats, &c. are respectively thrown together, some very essential objects of experience depend on guesses, which ought to be ascertained correctly. Has fallow, or clover, or beans, paid best, as preparations for wheat? How is that question to be answered, if all are huddled together in one barn or stack, and meet in the same account? The farmer can guess nearly. He may: but go to a chemist, ask him if his science was pushed to the present perfection by accepting such guesses, instead of experiment? besides, they are in their nature quite uncertain; and when a comparison is formed by two guesses, a very little error in each will amount to so much in both, as to overturn all authority. Another point is, a man's guess being influenced by a favourite theory: a rigid friend to fallows, when he draws, by guess, a comparison between them and beans, will be apt, in the nature of things, to be partial: he should not put himself in the situation: he who would abhor the idea of falsifying a fact that is before him, might guess, at least, without sufficient accuracy."

He adds, that "if the fields be not very small, the inconvenience of keeping crops separate is little. Stacking corn is better understood and executed in the Isle of Wight, than in most other parts of the kingdom: a great stack is rarely seen there: a farmer who has 500 acres of corn has only small ones. With such, accounts are kept separate with great facility. At least, if there be difficulties in it, there are others we shall meet with abundantly greater." And he observes, that "to sow one field with several crops at the same time, part wheat, part clover, &c.,

is very bad and inconvenient management, and ought to be avoided, were accounts out of the question. If they cannot be shunned, these must necessarily be more complex," under such circumstances.

He states it as his opinion, that "the first object in keeping accounts is to ascertain the expenses, in order to divide them accordingly."

They may be considered under various heads, as "*Rent, Tithe, and Parish Taxes*;" which, he says, "demand three accounts, to be kept separate; but they are all to be arranged on the same principle. The amount of the two last, when known, which is at the end of the year, must, like the rent, be divided over every field for which an account is kept: this is very easy, when the measure of the fields is known. He need not observe, that the farmer, in dividing the rent, should do it as exactly and as fairly as possible, and that the two other articles should be proportioned to the rent. But here occurs one difficulty, which is, he confess, puzzling: it is the difference between the gross and the neat measure of the fields of an inclosed farm. The hedges, ditches, and borders, take up, in many farms, a considerable portion of the field; from one-eighth, to one-twelfth, and in some, even more; now, if these be reckoned and accounted for as a part of the field, then the acreable produce is affected, and even the profit of the husbandry, by a circumstance not essentially connected with it; and if two fields be compared in their husbandry, that may be most advantageous which has least border, and for that reason, which would derange a comparison entirely. He knows, he says, but one method of getting rid of this difficulty, which is to measure the neat contents where the plough goes in an arable field, and where the scythes cut in a grass one, and then, deducting the total of those measures from the gross contents of the farm, throw the difference into one account by itself, under the title of fences and borders, to which account must be charged the proportion of rent, tithe, and parish taxes. If wood be cut or grubbed from these borders, or grass mown from them, the value of the wood or hay to be credited. The expense of the fences to be charged, and the balance of the whole for it, may every where be expected to prove a losing account, considered as the expense of *fences*, and acreably divided over the whole farm, like rent, tithe, or parish taxes. The only person who ever had an attention to this accuracy was, he observes, Mr. Baker, the experimenter to the Dublin Society. He published a map of his farm, with the gross and neat contents of every field. For want of observing the precaution, many experiments have, he thinks, been made, and many conclusions drawn, which are mere errors."

And "*sundry expenses* may be the title of an account, which must have place on every farm. Whatever payments concern the farm in general, and not any field or object in particular, and is not included in the preceding articles, must be entered under this title. Instances are: a bailiff's salary; payments to rat or mole-catcher; mending roads; expenses at markets, &c." Another is "*wear and tear*, which includes all payments to blacksmith, carpenter, wheelwright, harness-maker, &c. But in the division of this article, there must be a variation from the preceding; they are divided over the whole farm, but these must be proportioned differently: the arable lands will absorb the greatest part of these expenses; mowing grass, very little; and feeding-ground still less. But to avoid any arbitrary estimation when a rule can be established, the proper mode of dividing this expense per acre, will be by making the expense of the teams a rule for it: to find how much per cent. or in the pound, of the team-account, this expense of wear and tear amounts to, and charge it accordingly."

But "the *team*-account is, he thinks, that which is in general more mistaken than any other on a farm. Nothing is more common, than every day to see accounts in which ploughing is charged at 4*s*. an acre, or at 5*s*. or at 10*s*. or whatever may be the hiring price of the county: but few words are necessary, he says, to shew that this is entirely fallacious: it is probably much under the real expense. Every practical farmer must know, that the way to have cheap tillage is to keep the teams well employed: when a man's own work is done, his team stands still if he do not employ it for his neighbours; to do which, he will work for them below the value, and yet find some advantage in it. In consequence of such a conduct being common to say that such is the price of tillage, can never be accurate. It has by no means that best accuracy of *price;* because you cannot buy your commodity when you want it; and he who depended on the market for all the work of his farm, would soon find the state of his fields calling for a very different system." He thinks "the means of ascertaining the real expense of all team-work is very obvious, but depends totally and absolutely on accurate accounts. So much per week in summer for their green food; so much hay and oats eaten; so much for shoeing and farrier; so much for the actual decline of value; and so much in labour for attendance, give, says he, the real expense of the team. In order to divide this total expense among the work executed, a day-book is necessary: which a man may keep himself, or trust to his bailiff, as he pleases; it must contain the work of the teams and men every day in the year, specifying the field or business they are employed in. At the end of the year, the amount of expense is proportionally divided among the work, and the clearest truth and correctness are necessarily the result. This accuracy, says he, is very desirable for ascertaining various circumstances. The comparative profit of grass and arable land depends much on it. Some persons, from too lightly estimating the expense of teams, think arable the most profitable; and others, whose calculation of those charges runs perhaps too high, give too much in the counter opinion. He can easily conceive, that many strenuous advocates for fallows might lose a little of their warmth, if they knew what the expense of ploughing an acre of land really was on their farms. Such instances might be multiplied: they are indeed obvious to every one

capable of uniting the theory with the practice of a business."

With respect to "the article of manure, it is, he says, much more complex, and, upon the whole, the most difficult account there is for a farmer to keep. It must be arranged under the title *Farm-yard;* and it connects with so many objects, that no little care is necessary to keep it; and with the greatest attention some doubts will still remain. Suppose, says he, the system to be that of carting a stratum of marl over the yard before foddering begins: that expense is to be ascertained at once without any difficulty; but how is the straw to be charged? Cattle may be put out to straw in this country at 1*s.* or 1*s.* 6*d.* per week. At these prices a ton will pay about 7*s.* or 8*s.*; but, while the cattle may be thus supported, the farmer may buy straw, with a view to the dung, at 20*s.* or 30*s.* a ton. This contrast is difficult to settle. The price per week is arbitrary, though actual: men take them at those rates, because they have none, or not enough, of their own; and it is not ascertained what value cattle will really pay for the straw; which may be more, or may be less. The whole is uncertain. But with the straw of one's own crop, there is, he adds, a double difficulty; because there must be two valuations instead of one. We must reckon so much an acre, or load, for it, and so much a week for the cattle that eat it; but both suppositions. Among counter objections, we must chuse the least. The best method, perhaps, is to charge the *farm-yard* account with the price of the straw, at which it could be sold, deducting the expense of carrying it out; and to credit the same account with the price per week of keeping the cattle; which price is charged to the debtor-side of the *cattle*-account, as a part of the expenses of keeping them. Whatever labour is bestowed on the dung, in shovelling and cleaning yards, throwing up the urine, turning over, &c. is charged of course to it. When the whole is carted on the land, the total expense is divided by the number of cubic yards, and the price per yard ascertained. It is charged to the account of the fields on which it is pread; and though the whole advantage is by no means exhausted by one crop, yet the whole expense must be charged to the crop that receives it, or the accounts would be kept open so long as to create confusion" and uncertainty.

It is recommended, that "the time of balancing the books every year, should be that of entering the farm: this is most usual at Michaelmas; but the crop of the year is not then disposed of: to avoid valuations, which ought never to be relied on, when certainty can possibly be gained, the old year's accounts are to be kept open long after the new year ones are begun; that is, till the corn is all threshed and sold, till the fatting beasts are gone, and till all those circumstances are decided which relate to the preceding year. This is essential, he says, to exact accounts, and can by no means be dispensed with. In this case, valuations may be nearly rejected, but there are others in which no management can exclude them: these are, in *live-stock* not bought and sold within the year; and *implements.* A man may, says he, stock his farm with cows at 10*l.* each; but if he suppose them, some years after, to be worth the same sum, he will grossly deceive himself. He must value them every year, and also the young stock which he rears with a view to keep up the number, or for sale: and the rule by which he should make the valuation, ought to be the price they would sell for at the moment. The same management must direct him with succession beasts, bought or bred for fattening; and also with a flock of sheep." On which last head he observes, "that the want of keeping such accounts is alone the reason for a difference relating to the profit of sheep. Can any thing be a clearer proof of the barbarity of accounts as they are kept at present by flock-masters, says he, than the surprising question once in agitation among them, whether they gain or lose by their flocks. Such uncertainty could not obtain, he says, if farmers kept regular accounts. The description of the profits of a flock not being properly a calculation, but an account, it ought to be transcribed, he says, from a man's private books; unfortunately, they are kept in such a manner, that difficulties multiply at every step in the endeavour to understand them."

The "implements must, he says, all be valued every year, and the balance, being the expense, carried to the wear and tear account, of which it makes a part."

But "one of the most complex and difficult accounts, if not the most so of all, is, he thinks, that of grass-lands, fed. It involves itself with cattle of all kinds, with hay, with the team, &c.; and in such a manner as to make an accurate separation very difficult. How is the value of the food to be calculated? If 3*s.* a week for a cow or a bullock, or 6*d.* for a sheep be charged, it is merely arbitrary: such estimates are fallacious. They imply profits, but allow nothing for losses. On the other hand, if the actual profit or loss on the live-stock be made the product; in that case, the grass-land must be made a mere cattle-account: there are obvious objections to this; but it is, upon the whole, less objectionable than a valuation per week, which must, in the nature of it, lead to error. On this principle, the account may, he says, be kept in the following manner: One account opened for *mowing ground*, to which the rent, tithe, taxes, and all expenses, in one total for every field mown, are carried: and the credit of it to consist of the value at the market-price (carriage deducted) of the hay mown, as delivered to the team, fatting beasts, cows, sheep, &c. which several accounts are debited with their respective consumptions. But the fields which are mown have also an after-grass, which is fed; the account of the week's stock which are supported by it, ascertains the value in the manner presently to be mentioned." And "the account of *feeding ground* comes next: all the total debits of the fields must be carried to it. The credit-side

to consist of the food of the teams charged at the price per week, suppose 3*s.* 6*d.*, and of that of any cattle taken in to joist. These articles may be arranged; but those which result from profit on stock kept are not so easy. There is farther, he says, a *sheep*-account; a *dairy* one; and another for *fatting beasts*. In these are to be charged all the expenses peculiar to those articles: shepherd's wages, market expenses, &c. to the sheep; fuel, straw-yard, &c. to the cows; and the purchase-money of lean stock to the fatting beasts." And "further: the fatting beasts are put to turnips; the cows have turnips, the sheep have turnips; how is this to be accounted for? It creates a new difficulty; but we must examine the best mode of clearing it. If the cattle-account be charged with the prime cost of the turnips, that is, with the expense of cultivating them, it will by no means be fair, for the expense is usually greater than the value; and a man may in a turnip country buy them cheaper than he can cultivate them: he submits in some cases to a known loss, because he knows he shall be more than repaid in the barley that follows; but to transfer this loss to the cattle would be unfair. One way of proceeding is, to value the turnips at what they would sell for, and to debit the cattle-accounts with their respective consumptions. But there are two prices of turnips; one, for carrying the crop on to another man's land; the other, for eating them in the field. The latter ought to be the rate chosen on this occasion, charging the cattle with the labour and expenses of carriage. But the actual profit is a better guide," in his opinion.

It is added, that "here, therefore, at the end of the year, five or six, or more, unsettled accounts are open, not one of which can be closed but by reference to each other. Hence arises the great complexity of the farmer's accounts; but, amidst this apparent confusion, order must, says he, be made to arise, or our labour is vain." As "the main question on which this arrangement depends, is this—shall the profit or loss on live-stock be assigned *to the stock*, by a valuation per week; or, *to the land they feed on* by a division per week of the actual profit or loss arising? Suppose, says he, that two hundred pounds profit would be the balance of the sheep-account if food be not charged; shall this sum stand as *profit*, and the fields fed charged necessarily with *loss*; or shall that balance be distributed proportionably among the fields which have supported the flock? The balance of the account, 200*l.* amounts to 6*d.* per head per week for 52 weeks. They have been fed 15 weeks in *grass-lands fed*, 10 in *grass-lands mown*, 12 in *Great Staines* (a clover crop), 5 in *Ardera* (ruta baga), and 10 *Jermyn* (turnips). It is easy to divide the total among them; and if he wishes further accuracy, he may vary the price per week, according to the scarcity or real importance of the several sorts of food: but still keeping to the real total. This method of dividing the profit among the crops is far preferable, he supposes, to assigning the 200*l.* as profit to sheep." And the same thing "applies equally to all the other live-stock accounts." And "the farmer sees clearly, he says, what he makes by the different kind of stock, by turning to their respective accounts; but none of them appear in the profit and loss account; there they are absorbed in the accounts of the distinct arable fields which produced food; and in the two others of *grass-fed* and *grass-mown*; or in the two last thrown together in one of *grass-land*."

The able writer, however, allows "that there is a complexity in this mode of arranging the accounts of live-stock; but that after the greatest attention that he has been able to give it, he sees no mode of simplifying it." In this way, he says, "you have the satisfaction of all the accuracy that is attainable; but in any other method it will remain unknown, whether the profit or the loss belong to the land, or to the stock that feeds upon it." He says, that when "so much profit is actually made, to divide it by a weekly account to the fields that fed the stock, is making an easy calculation, with full data before you: but to charge the stock with so much per week for feeding certain fields, when you do not know but the account of stock may be loss, not profit, is calculating without any better data than mere supposition."

This is the plan which he lays down for the keeping the accounts of a farm; but does not offer it as a mode that obviates all objections, as he does not conceive it possible to obviate them all; but he thinks that fewer sources of inaccuracy will be found in it than in any other that is in use.

These rules and directions should be carefully weighed and attended to by the farmer, who is desirous of attaining the greatest possible accuracy in the cultivation of his farm, as it does not appear that any other plan can be adopted with a greater chance of correctness in the results.

The method most usually made use of will be seen below.

It is observed in the New Farmer's Calendar, that "every farmer, who desires to know correctly to what sort of purpose he does his business, should provide himself with a book, which he may call his General Stock-Book; and in this book he should now register the result of a general survey of the condition and worth of his whole stock and property, of his debts and his credits. Having such a book to refer to, at all times, and on all occasions, will afford an unspeakable satisfaction to his mind; nor ought he to enjoy the festivities of the season until he shall have completed his survey. Let him, in the first place, order in all his tradesmen's bills; in the mean time, he may take an examination and account (slight as he pleases) of his household goods; then a very particular one of his horses, cattle, and poultry; corn in straw, or threshed; hay and fodder, wood, manure, growing crops, and fallows; waggons, carts, ploughs, sacks, and implements of every kind; finishing with the state of his fences, gates, drains, &c. and an estimate of the necessary repairs on all sides. Memorandums being made upon waste-paper, the particulars may be afterwards copied into the Stock-Book, with whatever degree of

minuteness shall be judged necessary. After this general register, a Dr. and Cr. account may be drawn out, the balance of which will exactly show the present worth of the farmer's estate. The form of the account may be this:

" *Stock Dr.* *Contra Cr.*

" On the Dr. side must be entered all the farmer owes, beginning with rent, tythe, and taxes; on the Contra, or contrary side, all he possesses, and all which is owing to him. He must rate every thing at what he judges the fair present worth, was it then to be sold; manure and tillage performed must be valued at the common rate of the country; corn unthreshed, &c. he must take by estimation."

With respect to a general system of accounts, upon a farm, speaking to well-informed people, it is advised " to follow the Italian method, a beautiful system of arithmetical philosophy, which fills the mind with the satisfaction of certainty, and may be extended to every concern of life: but this method is out of question with common farmers, to whom common accounts are more suitable, and may be rendered perfectly sufficient. A farmer should keep a day-book and ledger; the first, because memorandums are so necessary in his business; and he need not be over studious of forms, entering down in his day-book whatever he may think needful to remember, with the day of the month.

" Every practical man knows the accidents that so frequently happen, from want of timely care of animals about to bring forth; by consequence, the date of their being put to the male should be correctly taken down: it is also of the greatest use, to keep an account of the dates of every sowing, and indeed of all the various transactions of tillage. Common accountants are apt to be frightened at the very idea of the trouble of Italian book-keeping; but there is a useful kind of half-method, unattended either with intricacy or trouble. It is merely to erect what are called stock-accounts, in a ledger, without any of the usual connections by reference. Thus, if a farmer desires to be very correct in his calculations of the profit, or loss, upon a lot of stalled oxen, for instance, or the crop of any particular field, his readiest method is, to make an account, for either the one or the other, in his ledger, Dr. and Cr. On the Dr. side let him place the cost, including every minute particular; on the Cr. the returns; in course, on sale of the articles, the account is closed, and the balance demonstrates the profit or loss. This will be found a much more certain future guide than the best memory."

It is further observed, that the author "is well aware what an alarm this recommendation of accounts may give to the indolence of many, perhaps of most, farmers; but it is remarked that the regular taking stock every year, and the keeping fair accounts, is, on calculation, attended even with less trouble than the everlasting puzzle, confusion, blindfoldedness, and loss, of heedless negligence. Regular accounts and annual valuation will not only afford a man an exact knowledge of his real situation, but wonderfully improve and sharpen his judgment, on the real worth of all those articles in which he deals: and in the necessary contemplation of the final accident, he will have the satisfaction to reflect, that all stands fair for the benefit of his family, and as little liable as possible to loss or dispute.

Insurance against accidents by fire should never be neglected or postponed an hour, in a situation like a farm, surrounded as the homestead is with combustible matter of various kinds.

DECIDUOUS, a term signifying falling, or not perennial; it is applied to such trees and shrubs as shed their leaves in the autumn. Thus the oak, the elm, the beech, &c. are called deciduous-trees.

DECLIVITY, an inclination downwards; or a gradual descent.

DEEAZED, a term provincially signifying killed, or much injured by cold, as vegetables that are frost-nipped; or chicks that die in the shell, through the absence of the hen.

DEER, the general name of animals of the stag-kind, of which there are several species. It is observed by Dr. Robertson, in his valuable Survey of Perthshire, that the red-deer is a species that is not so numerous in that district at present, as it was formerly, yet there is some remains of them. He adds, that the principal forest of that part is in Athol, in the heart of the Grampions; and that the duke of that name " allots many thousands of acres to his deer, is a great sportsman himself, and often resides in the forest for some days." He remarks, that " the stag or male-deer sheds his horns in spring, either earlier or later, in proportion to his age; the oldest always first. About Lammas their horns are fully grown, which are solid, cylindrical and ramified, with sharp brow antlers. During their growth, they have extreme sensibility, which decreases as they advance to their full length. The hinds have no horns. The horns of the fawns begin to appear, he says, when they are about six months old. In the rutting season, from the middle of September to the end of October, the stags are wildly furious, despising danger, and ready to attack every creature that annoys them." And he further states, that " the roe-buck and doe are in many parts of the county, almost in every district, which is not divested of wood; and although no sanctuary is allotted them, like the deer, they live nearer to the habitations of men; but always in the neighbonrhood of extensive and solitary woods, to which they may flee in the hour of danger. The deer are gregarious animals, and associate in herds, one being always appointed to keep watch, while the rest are asleep. The roes travel in single families, seldom more than four together, the sire, the dam, and two kids. At the rutting season, which is about a month later than with the deer, the kids are driven off in quest of a new settlement and a new connection; the old pair continue constant in their affection from year to year, unlike, says he, the faithless hart, which bellows mad with promiscuous love. The buck's horns are like the hart's, solid, cylindrical and

shedded annually, but much smaller in size, and having two points at the top. The sagacity with which the females of both kinds hide their young can only be equalled by that, with which the young keep close to their form, until the dam return to raise them."

After stating that the moose-deer is a species now extinct, he justly remarks in addition, that "the deer, like other cattle, rise in the bone by good keeping; and the breed degenerates when the pasture is poor. How different is the lowland cow from one reared in the mountains. When the deer enjoyed the extensive range of the most fertile vallies, and were fed undisturbed, by the most luxuriant grass, they must have been larger, both horn and hoof, than at present, while banished to the recesses of the highest mountains, and compelled to live on such coarse fare, as they can find on the mountain's brow. The horns of the moose-deer are palmated, like those of the fallow-deer, only larger; which is a surer characteristic of the species, than the size alone."

After observing, that "the only fallow-deer in the whole county are at Blair Athol and Taymouth, he says, he does not know any species of tame animals, that are more elegant in their appearance, if they be well selected, or better suited for occupying an extensive lawn, which stretches round the castle of a great man."

The author of the Agricultural Survey of the County of Hertford, observes, that "the Earl of Clarendon, justly considering that there is no more impropriety in converting one animal to profit than another, makes deer an object of husbandry. As soon as the rutting season is over, or usually about the 10th of November, his Lordship selects from the herd, the weak ones, some of which would probably die in the winter, and keeps them in a small yard that has a shed on one side, and a net over the whole against pigeons, &c.; the spot very warm, and well sheltered. Their horns are immediately sawn off, the place is well littered, and they are fed at a very small expense on pea-straw, hay, &c. warmth making up for the want of better food. At times, during the winter, they have clover-hay cut into chaff, and if they do not eat it well, a little salt is added. They have always plenty of water, and are kept perfectly clean: much attention should, he says, be paid by the keeper to make himself familiar with them, that he may enter the place without disturbing them. The first week in March he gives them oil-cake, about half a cake each a day with chaff, which fattens them so quickly, that all are gone in May. Before killing, they have some green meat given, to take away any ill flavour from the cake, supposing such to be the effect of the food, for it is certain that the venison is exceedingly good. As to weight, a haunch usually weighs about 24 pounds; a brace is sold for 15 guineas: the skin, worth 2*l.* 2*s.* is the keeper's perquisite; so that the value of a brace amounts to 17*l.* 17*s.* exclusive of some trifling articles. The purchaser sends for them."

It is added, that "his lordship usually fattens nine brace: his whole winter-stock rises to 350 head in a park of 250 acres, but much of it is thickly covered with timber; 30 sheep and 10 cows also feed in it. The park consumption of hay amounts to 32 loads, being reduced to that quantity by the use of much browse; all ash, elm, and Scotch fir, being brought for that purpose before faggotting, which not only saves hay, but improves the flavour of the venison."

Mr. Young remarks, that he had "from various information conceived, that breeding deer for sale was a very unprofitable business; but the circumstance stated in this account, of selecting such as would probably die, or be unprofitable to keep, places the estimate of advantage in quite a new light: thus considered, says he, the speculation seems a profitable one. It is not uncommon, he adds, to hear of great winter losses of deer in parks, for want of a system in which such can be applied to advantage: nothing of this sort can be well done, that is not in a regular course; but, by this practice, every deer which from severity of season, or from accident, would be lost, is converted to a great profit; as in such cases the expense of fatting is a trifle, the greater burthen of bringing them to an age for sale not belonging, says he, to the account of this system. Some have fattened well that have had their legs broken by accident. On the manure being mentioned, he made the common objection, that deer's dung is good for nothing; but this Lord Clarendon conceives to be a great error: his lordship had an experiment made to ascertain it; he manured for turnips, three lands; one with stable-dung, one with deer's-dung, and one without manure; the two manured were nearly equal, if any difference, it was in favour of the deer; the other of course was much inferior. There are loop-holes in the fence, he says, through which they are shot," when in a state to be killed.

This is a simple system, which shows that an animal that has been little attended to in a farming point of view, may be turned to considerable profit.

Deer-*Neck*, in *horsemanship*, a thin ill-formed neck. See *Neck*.

DEFECATION, the act of purifying any liquor from the lees or dregs.

DELVE, a term signifying to dig with a spade. It also implies to dint or bruise, as, a pewter, or tin vessel.

DELVING, a term provincially applied to digging, or the act of turning up the earth with a spade.

DEMAIN, or *Demesne*, the land which a man holds originally of himself. It is also sometimes used as a distinction between those lands which the lord of the manor hath in his own hands, or in the hands of his lessee, and such other lands appertaining to the said manor as belong to free or copy-holders.

DEMULCENTS, in *farriery*, such remedies as are supposed to lessen the effects of acrimony.

DENSHIRING, a term formerly used for the operation of burning. See *Paring and Burning*.

DEOBSTRUENTS, in *farriery*, such remedies as are supposed capable of opening obstructions.

DESICCATIVE, in *farriery*, a term applied to such remedies as have the power of drying up or healing over old sores.

DESS *of Hay*, a term sometimes used to signify a cut of hay.

DESS-UP, a term signifying to pile-up neatly.

DETERGENTS, in *farriery*, are such remedies as cleanse and fill up different sorts of ulcerations.

DEVIL *in a Bush*, the name of a very troublesome weed among corn, where it abounds. It rises with slender stalks, near a foot high, which sometimes branch out at the bottom, and sometimes are single, garnished with a very few fine-cut leaves, somewhat like those of dill. Its flower is generally blue, and its seeds are rough and black. This, together with their being nearly of the same size as the grains of wheat, renders it difficult to separate them from the corn, when the plant has been cut and housed with it; they blacken the meal, and debase its value. The plant is annual, and therefore may be extirpated by rooting it out before it can seed, which is commonly in August.

DEVIL'S-*Bit*, the name of a weed often found among corn, but more frequently in meadows. It has a strong, thick, fibrous, perennial root, which runs deep into the ground, and sends out several branching stalks, which rise near three feet high. The lower leaves are sometimes almost entire, and at others they are cut into many segments almost to the mid-rib; they are seven or eight inches long, and from three to four broad in the middle, hairy, and sit close to the root. The stalks are covered with stiff prickly hairs, and garnished with smaller leaves at each joint. The flowers are of a pale purple colour, and have a faint odour, appear in June upon naked foot-stalks at the end of the branches, which decay to the root every autumn.

DEVIL'S-*Guts*, a provincial term sometimes applied to bind-weed. See *Bind-weed*.

DEVONSHIRING. See *Paring and Burning*.

DEW, the moisture which is precipitated from the atmosphere, and falls on the ground, and on the leaves of plants, blades of grass, &c. during the night. The dew, from its containing a large proportion of oxygen, may readily be conceived advantageous in promoting the growth of plants.

But for a more full explanation of the nature and properties of dew, in regard to vegetation, see *Atmosphere*.

DEWLAP, a term applied to the membranous fleshy substance that hangs down from the throats of neat-cattle.

DIABETES, in *farriery*, a morbid copiousness of urine, or the making of pale water in too great quantities. It is attended with a coldness of the skin, a stairing of the hair, weak pulse, loss of appetite, continual thirst, and great loss of strength. It is supposed to be caused by such circumstances as have a tendency to induce dropsical affections. It has been attributed by a late writer, to bad diet, such as oats that have been injured by salt-water. This disorder is very common in horses, and often terminates in death. Horses subject to a diabetes, or profuse staling, if old, or of a weak constitution, are seldom cured; they soon lose their flesh and appetite, grow feeble, their coat staring, and they die consumptive. Of young horses, there are, however, more hopes; but they must not be indulged with too much water or moist food. The following drink may frequently be given with advantage:

> Take of Peruvian bark, four ounces; of bistort and tormentil root, each two ounces: boil them in two gallons of lime-water to the consumption of half, and give a quart three times a day.

The horse should at the same time drink two or three quarts a day of lime-water; and if these medicines do not succeed, a quart of strong alum-posset may be given three or four times a day.

A remedy advised by Mr. Denny, on the first discovery of the disease, is this:

> Take of alum in powder two drachms; Armenian bole, Peruvian bark, in powder, each half an ounce; ginger, in powder, two drachms; treacle enough to make a ball, which should be given morning and night.

Mashes, with lime-water, should be given at the same time, and the horse be walked for exercise, being allowed warm clothing and good grooming. During the recovery, good nourishing food should also be frequently given.

DIAPHORETICS, in *farriery*, such remedies as promote sweat.

DIAPHRAGM, in a horse or bullock, is a muscular substance that divides the upper cavity or chest from the lower belly.

DIARRHŒA, in *farriery*, a disease of the bowels, attended with a frequent discharge of fæcis. See *Looseness* and *Scouring*.

DIBBLE, an instrument or stick to make holes in the ground for setting grain or plants, &c.

DIBBLING, a mode of setting corn or other seeds, practised with advantage in places where labour is cheap; it is chiefly made use of for putting wheat-crops into the ground.

It is observed by Mr. Donaldson, that the practice of dibbling, or setting wheat by the hand, was first introduced into Norfolk about twenty years ago, by a person who possessed a small farm in the neighbourhood of Norwich; and that this practice, which gradually gained ground in that district, has now become pretty general in the adjoining counties of Cambridge and Suffolk. In both of these, as well as in the county of Norfolk, considerable quantities of wheat are annually set by hand; but, in the last, where this method was first adopted, the quantity of wheat now planted by hand is not nearly so considerable as it was a few years ago. The wheat is generally dibbled in October, on land newly broken up from clover-ley. When the soil is of a light nature, it is usually rolled before the seed is planted; the method of doing which is as follows: A man, with an iron dibble of about three feet long in each hand, walking backward, makes two rows of holes in each furrow, slice, or flag; these are made about four inches distant from each other, and

from one to two inches deep. The dibbler is followed by two or three women, boys, or girls, who drop two or three grains into each hole. The field is afterwards bush-harrowed, by fixing thorns to a gate, and drawing it by one horse along the furrows. The usual quantity of seed is about six or seven pecks, and the expense of setting from nine to ten shillings the acre. An experienced dibbler, with three active attendants, will plant half an acre a day, making six holes in every foot-length along the furrow-slice. The advocates for dibbling wheat state several advantages which, in their opinion, result from adopting this method in preference of the ordinary one of sowing broadcast. They say a considerable quantity of seed is saved; that the grain is better, more equal in quality, and the increase greater; and further, that by the general establishment of this practice, the poor would find employment. There is no doubt but that a considerable saving must take place in the article of seed, when the grains are dropt at regular distances, in place of being scattered promiscuously. The quantity is said to be in general about a bushel the acre. Were no other benefit derived from adopting this practice than saving a bushel of seed on the acre, that, at the ordinary price of wheat, is more than counterbalanced by the extra expense incurred. The farmer, in order to save this bushel of wheat, value five or six shillings, must pay his labourers nine or ten. On this principle, therefore, he says, the practice cannot be defended. It is natural to suppose, and will be readily admitted, that a crop of planted wheat will always be to a certain degree better and more equal in quality, and (although, from that circumstance, probably chiefly) greater in quantity, than that sown broadcast. The crop, springing up at regular distances, enjoys, during the whole period of its growth, a more free circulation of air, and derives greater benefit from the rays of the sun, than when, by sowing the seed too thick, or irregularly, the plants stand so close together that both are in a great measure excluded. There is another reason why the grain should be of a better quality. It was observed, that wheat is commonly dibbled on land broken up from one year's clover. When wheat is sown broadcast on such lands, a great many of the seeds fall naturally into the interstices of the furrows, where they are either choked, or retarded in their growth, by the weeds, which spring up there in greater abundance than in the other parts of the field: whereas, when the seeds are set in the slice or flag, the plants cannot meet with any impediment to retard their growth. Although, for these reasons, it is highly probable that the produce of dibbled wheat must always be superior in quality and quantity to that sown broadcast; yet, without repeated experiments, or the establishment of a law whereby all grain shall be sold by weight, it is impossible to determine the extent of that superiority; or whether so much advantage results therefrom as to encourage farmers in other parts of the kingdom, if practicable, to adopt the same method. Some people, says he, have gone so far as to assert, that dibbling wheat is one of the greatest improvements in modern agriculture; and that owing chiefly to the circumstance of its furnishing work for the poor. In a populous district, where agriculture is almost the only employment of the inhabitants, and where the poor-rates have advanced to an extravagant height, the introduction of any new practice, whereby the poor can be usefully employed, while the individuals who furnish that employment, if they are not benefited, are not injured thereby, must be deemed a very essential improvement. Dibbling wheat, therefore, in districts so situated, especially if followed out by hand-hoeing, so as to afford still longer work, may be a very proper way of furnishing employment for the peasantry. But, he thinks, in a country like Great Britain, where the great body of the people are alternately employed in warfare, or in commerce and manufactures, and the ordinary operations of husbandry, the impracticability of rendering this a general practice must be at once obvious. The population must indeed be amazingly increased before that can happen. Populous as this island now is beyond what it was at any former period, yet were a law enacted, that all grain should be planted by hand, it would be necessary, he says, that all ranks, the governors as well as the governed, should learn how to use the dibble. In a word, although the practice may be beneficial as well as laudable in some particular districts, no person in his sober senses will, he asserts, think of recommending the general establishment of it as an improvement in the national agriculture.

It is observed in Dickson's System of Agriculture, that "dibbling or setting the seed singly by the hand, is a practice that was known and slightly employed at an early period of the art in this country, and which has lately been restored by an intelligent agricultor (Mr. Varlo). It would seem to have been introduced into the county of Norfolk, where it has since been practised to a considerable extent, about twenty years since, by the cultivator of a small farm in the vicinity of Norwich. Since that time it has extended itself into different neighbouring districts, as those of the counties of Suffolk and Cambridge, and is also said to be practised in Lincolnshire, with success.

Mr. Young, in his Report of Suffolk, says, that "for wheat, in some districts, a narrow set-plough, of only seven inches width at bottom, is used to plough with; a one-horse roll then follows to level the flag, or furrow, for the dibblers, who strike only one row upon each: when the wheat is deposited, two or three kernels in each hole, a two-horse roll follows, and afterwards the harrows twice in a place; when the field is finished in this manner, it is harrowed up again obliquely: by this method the wheat is deposited in the middle of the flag, at nine inches distance in the rows; and when come up, has the appearance of being drilled; the two-horse roller is supposed of material use in closing up the holes, and preventing the wheat from being disturbed by harrowing; and the land is made so solid by rolling, that very little apprehensions are entertained about

the slug or worm. If there should be occasion to hoe in the spring, the operation can be easily and cheaply performed. Bush-harrowing is supposed of very little use; as it can only sweep the dust or light mould over the holes, and in the first shower of rain that follows most of them will be seen, and much of the wheat be swelled out of them."

The practice of dibbling peas and beans, which is sometimes done separately, and sometimes mixed together, is chiefly, Mr. Donaldson says, confined to Gloucestershire, and the operation for the most part performed by women. As soon as the land can be got properly harrowed, and the surface smoothed, in the spring, that is, between the beginning and middle of February, the work of setting commences—in some places, in rows across, but more frequently along the ridges. Some setters use a line to direct them in forming the rows at equal distances; others again, particularly those who have been long used to the business, do not consider a line as necessary. The setters begin each at the end of a row, and making holes at the distance of about two inches from each other, and about the same depth, deposit one pea or bean in every hole; and thus proceed, till the work be completed. The distance between the rows is seldom less than ten, and, in few instances, more than fourteen inches. The quantity of seed necessary is from two and a half to three bushels, according to the distance of the rows; and the price of setting from 3*s.* 6*d.* to 4*s.* 6*d.* the acre. When the setting of the field is completed, it is gently harrowed, in order to cover the seed, and the crop is repeatedly hand-hoed afterwards, as occasion requires. If, says he, the object which the Gloucestershire farmers have in view in adopting this practice be to furnish employment for the poor, the crops being always repeatedly hand-hoed by the persons who were employed in putting the seed in the ground, is a strong additional circumstance in support of the justness of the principles on which it was adopted, and of which those who are in the habit of setting wheat cannot avail themselves. If an extraordinary number of people be not employed, these repeated hoeings must take up a considerable period; and will not, in ordinary cases, be finished before the commencement of hay-harvest; which being again succeeded by the corn-harvest, the industrious poor are thus furnished with almost uninterrupted employment in the fields for six or seven months. In districts where the poor, from long habits of idleness, have become numerous, profligate, and useless members of society, this must be considered in every point of view advantageous: while, under other circumstances, this method of managing bean-crops might be impracticable, from the rate of wages, and the people being fully employed in manufactures; or, if practicable, neither beneficial to the community nor to individuals. Where these circumstances occur, and they fortunately do so over the greatest part of this island where improved agriculture is practised, drilling beans, or dropping them in the bottom of every second or third furrow, and afterwards horse-hoeing the crop, will be found a method not less favourable for the soil; and, if at all, but in a small degree, less profitable to the farmer.

"It will obviously be necessary, Dr. Dickson says, with these crops, to have larger spaces between the rows, and greater distances in them, which must render a larger portion of ground capable of being planted in a given time. When the children engaged in performing the work of dropping the seed into the holes, are only able to drop into one hole, six are required to follow one dibbler; when capable of dropping into two holes, three are sufficient for one dibbler; and where they can drop into three holes, two are only requisite for a dibbler. The wages are various according to these circumstances; for those who perform in the first manner, it is generally three-pence a-day for each child, in the second it is seven-pence, and in the third about ten-pence halfpenny." And "four men to perform the business of dibbling, with a suitable number of droppers, are considered as sufficient to work in one party, which is a much better practice than that of allowing the whole to work together, as the seed is set with much greater regularity and exactness."

In regard to "the expense of performing the business, it is generally about nine or ten shillings an acre for wheat, eight for barley and oats, and seven for peas or vetches; but this must evidently be liable to considerable variation, according as the situation is populous, and the price of labour cheap, or the contrary. In some of the dibbling districts, the difficulty and expense of the hand method have been attempted to be lessened by the use of machinery, such as rollers of the drill and spiked kind. The manual practice is, however, to be preferred where labourers can be procured. This circumstance of using implements for the purpose of putting in the corn, has probably led some to suppose that the practice of dibbling was more on the decline than is perhaps really the case."

With respect to "the kinds of soil on which this method of putting in the seed has been practised with the most advantage, they are the light and mixed sandy, and those of a loamy quality. On the deep stiff clays, it is seldom had recourse to. The newly broken-up lands of almost all descriptions may, in most cases, be advantageously planted in this way. And various sorts of crops have been found capable, in particular situations and circumstances, of being put into the ground in this way with advantage, such as those of wheat, barley, oats, peas, beans, and vetches; the first is, however, the kind of crop for which it is the most commonly employed. Oats may, in many cases, be beneficially dibbled on such lands as have been newly ploughed up from leys. But it is supposed by the author of the Suffolk Report, that barley can seldom be dibbled, by reason the land is so dry in April, that the holes will run in, and not stand open to receive the seed."

In relation to the season for executing the work, "in the more southern parts of the kingdom, the most favourable for putting in wheat, in this mode, has been found to be the latter end of September,

or the beginning of October; the months of March and April for barley and oat-crops; and for peas and beans as early in the spring-months as the nature of the season will admit of its being done."

In regard to "the quantity of seed that is required in this method of putting it into the ground, it is considerably less than where the broadcast, or perhaps even the drill-system, is followed; but the savings must constantly depend, in a great degree, upon the steadiness and accuracy of the persons employed in dropping the seed, and the number of the seeds that are put into each hole. It has been suggested by an experienced cultivator in this way, that where the droppers are properly attended to, the saving in wheat may be about six pecks in the acre, in barley eight, and in peas and vetches about four."

It has been observed in a late practical work, that "the number of grains that are deposited in each hole, is different in different circumstances; but the most general practice, and that which has been found the most successful, is three or four for grain-crops, and one or two for those of peas, beans, and others of the same kind. It is evident, however, it is supposed, that they should neither be set too thickly, nor in too thin a manner: as in the former case the plants may be drawn up, and the crops in consequence become weak and not productive; and in the latter, as where only one grain is placed in each hole, they may be so thin as to afford but a scanty produce from the want of plants. Where due care has been taken in the putting in of the seed, there is mostly a considerable increase of produce in this way of sowing over the others. The exact amount of the additional produce that is thus obtained, has not, however, been fully shewn by the experiments of intelligent cultivators; but it has been supposed, in respect to wheat, to be from four to six bushels in the acre, in the Report of Agriculture for Norfolk, and the result of an experiment made with the view of ascertaining the difference in the produce between sowing and setting barley, proves it to be still greater in that sort of grain, the experimenter having had twelve bushels on the acre more in the land that was dibbled, than that which was sown. Conclusions drawn from loose estimates, or single experiments, says the author, cannot, however, be depended upon, but it can scarcely be doubted that the quantity of produce is greater in the method of dibbling the seed than in sowing it broadcast. In the quality of the grain there is likewise a superiority: the wheat and barley produced in this way are said to be not only more free from dross, but larger in the kernel, and of course weighing considerably heavier. It is easy to perceive, that when the seed is put into the soil in the regular and equal manner that is the case in setting with the hand when well performed, the crops, of whatever kind they may be, may have a superiority in these different respects, both from the plants in such instances being less crowded together, and their becoming in consequence more strong and vigorous, and from the air and sun being more fully admitted, by which they become more equally, as well as more perfectly, ripened. It is probable too, that in such cases, from the greater regularity of the plants, the hoeing or after-culture of the crops, where it is practised, may be more effectually and more fully performed. There is also another reason, that, in particular instances, has been suggested as the cause of the quality of the grain, in this mode of sowing, being superior, which is that of wheat being frequently dibbled upon such land as has been broken up from a new clover-ley, in which case the seeds being set in the furrow slice, or flag, the plants are not liable to be obstructed in their growth; whereas, when sown in the usual broadcast method, much of the seed must of course fall into crevices and openings between the furrow-slices, where they must be greatly impeded in their vegetation by weeds and other causes. This shows likewise, he thinks, the absurdity of putting wheat-crops in by the broadcast method upon such preparations of the land."

The advantages of this mode of putting in crops have been shown in several papers inserted in the fourth volume of Communications to the Board.

DICK, a provincial word applied to the mound or back of a ditch.

Dick-*Hole*, a word applied to the excavation or ditch itself.

DIET, in *farriery*, a term applied to such articles of food as are to preserve health, or assist in the cure of disease. The diet proper for sick horses, where they retain their appetites, must be according to the nature of the disease, and be given in a small quantity at a time, frequently repeated; it should mostly be of the softest kind, as scalded bran, boiled barley, malt, or dry bran, if the horse refuse soft food.

"When a horse refuses food of every kind, it is too common, Mr. Clark says, to force it upon him, by pouring wine-sops, &c. down his throat, under the apprehension that the horse will die for want of nourishment. This, however, is not the case: if the animal loaths food, it is a certain sign that he is disordered, and therefore cannot digest it; and the throwing or forcing it into the stomach will serve only to aggravate the disorder under which he labours, by increasing that oppression which already prevails. It is farther to be observed, that the stomach of a horse has not the faculty of vomiting, or even belching up wind by the mouth, which, in such cases, might give relief. If a horse will drink water freely, he considers it the best medicine in such a situation, as it dilutes the contents of the stomach, and thus affords an easier passage for them into the intestines. For these reasons, he advises, that no food whatever should be *forced* on sick horses; neither should they even be *tempted* with oats, or other relishing food, as it is by no means proper for them in such a situation, although they should seem disposed to take it, which they frequently will by way of change." Where, however, the existence of the animal, or his recovery, seem to be endangered by a continued rejection of food, it should, he says, be remembered, that art furnishes another resource to

support him, which is, by clysters. These will, however, seldom be necessary, where proper attention is bestowed in the early part of the disease.

DIG, a term provincially applied to a mattock. It also signifies to break up the ground with that or any tool which requires a stroke in using it.

DIGGING, the act of turning up the earth with a spade. Were labour cheap, and a sufficient number of hands could be found, it would be the best way to dig by hand all grounds destined for potatoes, carrots, &c. as many advantages would accrue from that method of tillage; the earth would be loosened to a greater depth, and much better pulverised; and the weeds and grass would not be so apt to grow as in ploughed lands. Under such circumstances waste-lands might frequently likewise be advantageously broken up.

DIGITATED, branched out into divisions like fingers.

DIKE, a term in some places applied to a ditch. It also signifies a dam or mound to hinder inundations; and sometimes a water-ditch.

DILL, a term sometimes applied to the two-seeded tare, a species of large vetch, which has been cultivated on the Cotswould-hills, principally for hay, for a vast length of time. See *Vetch*.

DILUENTS, in *farriery*, such remedies as are supposed to have the power of thinning the fluids. Decoctions of bran, &c. are of this sort.

DINDLES, a provincial word applied to the common and corn sow-thistles, as well as the taller hawk-weeds.

DINGLE, a small clough or valley between two steep hills.

DISCUTIENTS, in *farriery*, such remedies as have the power of repelling or driving away the matter of tumors, &c. without their suppurating.

DISEASE, a derangement of the actions or functions of the whole or a part of either an animal or vegetable.

DITCH, a trench cut in the ground, usually round the fences of a field. Trenches of this kind are made differently in different places, but they should always be made so as to keep the water from stagnating in them.

Ditches on hill-sides should be made to face uphill, especially where the subsoil is springy: for, if the springs work through under the bank, they soon undermine and let down the face, together with the layer, into the ditch. The outside of the ditch is of much less consequence. The ditches in every part of the vale of Glocestershire are, Mr. Marshall says, "shamefully neglected. A vale district, without deep clean ditches, reflects disgrace on the owners as well as the occupiers of the lands. In a district that, by natural situation, is too cold and moist, every possible means ought to be used to free it from surface-water; which, if it stand only an hour upon the soil, or in immediate contact with it, adds more or less to its natural coldness."

The mud of ditches affords an excellent manure, as it consists of the putrid particles of animals and vegetables, mixed with the finest and richest mould; and therefore is a great improvement to any soil, particularly the light and dry. But such mud should be exposed to the air for some time, that the seeds of the weeds generally contained in it may have time to vegetate or putrefy, before it be laid on the land. See *Fence*.

DITCHING, a term applied generally to fencing with hedge and ditch.

DIURETICS, in *farriery*, such remedies as have the power of forcing urine. See *Ball*.

DOCK, the name of a well-known plant or weed, of which there are several species, and all of them remarkable for the largeness of their leaves; so that they must be very slovenly farmers who suffer any of these plants to grow large. They should be plucked up by the roots as soon as they appear, which may easily be done, as the roots are of the tap or carrot kind.

Mr. Marshall observes, in his Rural Economy of Yorkshire, that "this weed matures its seeds quickly, and in great abundance; but that they have no wings to scatter them to a distance; they fall at the foot of the plant. This renders a creeping root unnecessary. Nature's chief care seems to have been to establish the parent plant firmly in the soil, and to guard against its destruction. To this end it is furnished with a very strong perennial tap-root, of singular properties. If divided below the crown, the part left in the ground sends forth sapling-shoots; and this from almost any depth, provided it have head-room, or the soil be loose. The upper part too, if cut off a few inches deep, will survive the amputation. Even when inverted with the plough, it will recoil, and find its way to the surface again. In this case, therefore, the plough alone is an improper implement of destruction. On the contrary, it may, and frequently does, increase the number of plants; the part cut off, and the part left below the plough, both of them surviving the separation. Hence it is evident, that land which is infected with docks should be gone over with the drawing-iron or the spade, some time before the plough be put into it, that the tops may be removed, and the rootlets left in the ground may have time to rot before the land be ploughed. With this precaution, and with a person to follow the plough with a spadlet to grub up the bottoms, and to disengage the top of such as may have escaped the previous weeding, the roots of docks may with great certainty be got rid of. The seeds of docks are to be destroyed in the same manner as those of other weeds; namely, with the plough, the harrow, and the roller; with this difference, however, that in destroying the seedlings of the docks, or any other strong-rooted perennial plant, the intervals between the ploughings should be short; for, if they once get themselves established in the soil, it is, without a favourable season, out of the power of tillage to extirpate them. Another precaution with respect to the seeds of docks is necessary: they are sometimes sown upon the land with corn, and very frequently with clover. From corn and pulse they may be separated with the skreen, and still more effectually with the sieve;

and no man can, in common prudence, sow any species of these until the seeds of weeds have been separated with the utmost care. But from clover-seed, the seeds of docks cannot easily be separated: they are nearly of the same size and the same weight: neither the sieve nor the fan can part them. Singular caution therefore ought to be had in the purchasing of this seed. If every man would be cautious in this matter, the growers of that article would be assiduous in weeding their seed-clover from this pernicious and disgraceful weed. To suffer one dock which has matured its seed to be threshed with seed-clover is a crime which ought, among farmers, to be deemed unpardonable.

Dock, in *farriery*, a large case of leather, as long as the dock of a horse's tail, which serves it for a cover, and is made fast by straps to the crupper, having leather thongs that pass between his thighs, and all along the flanks to the saddle-straps, in order to keep the tail tight, and to hinder it from whisking about, or being disturbed.

Dock, a term signifying to trim the buttocks, &c. of sheep.

DOCKEN, a term provincially applied to the dock.

DOCKING, in *farriery*, the art of cutting off the tails of horses. This operation is in general very successfully executed by the common methods, which are known to every farrier. But sometimes a miscarriage ensues, by an inflammation and gangrene succeeding. These accidents probably arise from the tendons of the tail suffering by an injudicious application of the knife or searing-iron, or from an improper season for the operation. Neither the very hot or cold months are proper, for reasons sufficiently obvious. The operation should always be performed by incision, or the chopping-engine; the knife being passed through the tail from above, whilst it lies on the block; for, when the cutting instrument is applied underneath, the blow is given on the tail, which, by bruising the tendons, may be naturally suspected to occasion bad symptoms. The searing-iron should be smooth, and better polished than those generally used, and ought to be rubbed clean with a woollen-cloth before it be applied to the stump; otherwise the sparks which fly from the iron are apt to occasion great pain, attended with the swelling both of the sheath and fundament: nor should it ever be applied flaming hot, for then it brings the burnt part away with it, and requires a re-application, in order to form a fresh eschar on the vessels; by which means the bone is frequently left too much exposed, so that it is a considerable time before it is covered.

Farriers seldom apply any thing to the stump; which need only be anointed with the wound ointment; and when the eschar is digested off, may be washed with alum or lime-water: but if an inflammation ensues, with a discharge of thin matter, a proper digestive, composed of Venice-turpentine, rubbed with the yolk of an egg and tincture of myrrh, should be applied, with a poultice of bread and milk over it. The rump should be frequently bathed with vinegar, and a quantity of blood taken away. If the fundament be at all swelled, and the inflammation at all suspected to be communicated to the bowels, let cooling emollient clysters be injected two or three times a day. Should a gangrene ensue, add ægyptiacum to the dressings, and spirits to the fomentation; and apply over all the strong-beer poultice, with London treacle, twice a day.

DODDED *Sheep*, such sheep as are without horns.

DODDER, the name of a very remarkable plant of the weed-kind, that cannot easily be mistaken. It is entirely without leaves, and does not depend wholly upon the ground for nourishment; but, when it is grown up, rots at the bottom, and lives upon the juices of other plants which it entwines itself round, by means of threads of a red colour, which it throws out. The flowers are small, and come out in roundish heads or bunches, many of them together, here and there, from the stem. See *Bind-weed.*

DODMAN, a name given in some of the northern counties to the shell-snail.

DODRED-*Wheat*, a term provincially applied to red wheat, or such as is without beards.

DOG, a domestic animal, of great use to man, in different respects. In order to keep animals of this sort in health, the following circumstances should be carefully attended to: Much in the first place depends on their diet and lodging; frequent cleaning their kennels, and giving them fresh straw to lie on, are very necessary; or, in summer-time, deal-shavings, or sand, instead of straw, will check the breeding of fleas. If the dog be rubbed with chalk, or brushed and combed once or twice a-week, he will thrive much better; the chalk will clear his skin from all greasiness, and he will be the less liable to be mangy. A dog should never be without clean water by him, that he may drink when he is thirsty. In regard to food, carrion is by no means proper. Barley-meal, the dross of wheat-flour, or both mixed together, with broth or skimmed-milk, is very good food. For change, a small quantity of graves, from which the tallow is pressed by the chandlers, mixed with flour, or sheeps'-feet well baked or boiled, are a very good diet; and when they are indulged with flesh, it should always be boiled. In the season of hunting, it is proper to feed them on the evening before; and give them nothing in the morning when intended to be taken out, except a little milk. In the day, they may likewise be refreshed with a little bread and milk, where convenient. In summer, *twitch* or *dog*-grass is of use to them.

The most common diseases and accidents of these animals are:

1. *Bites and Stings.* Where they are bitten by any venomous creature, the blood should be squeezed out, and the place washed with salt of tartar and water; then a plaster laid to it, made of turpentine and treacle.

2. *Mange.* Dogs are subject to the mange, from being fed too high, and allowed no exercise, nor an

opportunity of refreshing themselves with dog-grass; or else by being starved at home, which will cause them to eat the vilest stuff abroad, such as carrion, or even human excrement; or by want of water; and sometimes by not being kept clean in the kennel. These will probably heat the blood, and have a tendency to make them mangy. The cure, we are told, consists in giving them flowers of brimstone, either in milk or mixed up with butter, and rubbing them well every day for a week with an ointment made of brimstone and lard, to which should be added a small quantity of oil of turpentine. Or, boil four ounces of quicksilver in two quarts of water to half the quantity; bathe them every day with this water, and let them also have some of it to lap. Or, a small quantity of weak mercurial ointment may be rubbed on the parts on the first appearance of the disease. This will also free lousy puppies from their lice. Or,

Take of euphorbium, two ounces; flowers of sulphur, oil of bays, soft soap, of each four ounces. Mix. Anoint the dog with it every other day.

3. *Poison*. When a dog is supposed to be poisoned with nux vomica (the poison usually employed by the warreners, which causes convulsive fits, and soon kills), the most effectual remedy, if immediately applied, is a vomit. For this purpose give him salt and water in large quantities; to administer which, you may open his mouth, and put a stick across to prevent his shutting it whilst you pour it down his throat, at the same time holding his mouth upwards. If a sufficient quantity can be swallowed, it will purge and vomit him; and, when his stomach is sufficiently cleared, and a free passage obtained by stool, give him some warm broth frequently, to prevent his expiring from faintness.

4. *Worms*. As dogs are frequently troubled with worms, particularly whilst they are young; in these cases, purges of aloes, with calomel, may be of use, repeated two or three times in a week. If this do not succeed, give an ounce of powder of tin, mixed up with butter, in two doses. Or, of the herb savin, dried and rubbed to powder, about as much as will lay on a shilling for a dose.

5. *Sore Feet*. Pointers, when hunted oftener than two or three days in a week, are liable to these sorenesses, and, unless their feet be taken care of, and good lodging given, as well as proper food, they will not be able to do that through the season. Therefore, after a hard day's hunting, wash their feet with warm water, and, when dry, bathe them with vinegar, which will take off the soreness.

6. *Strains, Bruises, or small Wounds*. When a dog, by forcing through hedges, becomes lame from a blow or strain, the part should be bathed with salt and vinegar. And if there be a wound, a plaster spread with basilicon should be applied over it.

7. *Coughs and Colds*. Dogs are subject to coughs, with choaking, which is thought to arise generally from a cold. If the complaint be a cold, let bleeding be used, and repeated in small quantities, if necessary; but if it be what is called the *distemper* in dogs, and they appear very low in spirits and have a weak pulse, the bleeding must be omitted. Let meat-broth, or milk-broth warmed, be the principal part of the diet, using at the same time the following medicine:

Take of flowers of sulphur, cold-drawn linseed oil, salt-petre, of each an ounce.

Divide this into four doses, giving him one dose every other day, with one spoonful of honey; and let him have plenty of clean straw to lie on.

There are several other disorders to which these animals are liable; such as canine madness, &c. which are considered under their proper heads.

Dog-*Fennel*, a term provincially applied to the weed corn-chamemoile, sometimes dog-fennel.

DOGGEDLY, a word provincially signifying badly, or shamefully.

DOG'S-TAIL-GRASS, a common name applied to the brisled dog's-tail-grass, which is a grass that has been much recommended as a favourite and wholesome food for sheep. It is found in the soundest and best pastures, but grows best in dry situations; and will not thrive in meadows that are very moist. It flowers nearly at the same time as the meadow fescue-grass, but is not very productive of foliage. It is said, that the appearance of its bents in poor, high, moist pastures, has suggested the idea of its being an indifferent plant. But its abounding in most of the richest grazing pastures in different parts of the kingdom, and its being in some the principal herbage, leads to a conclusion that it is a useful grass. As its flowering stems and heads are seldom consumed by cattle, its seeds may be collected, where the pastures are fed, with great facility; and, as they are abundant, may be gathered by children at about one shilling the pound. It is maintained, that land may be laid down with it in a successful manner, if proper attention be bestowed in having the seed collected when fully ripe, as it has been known to fail on this account. On the continent, it is in high estimation as a pasture-grass. From the fibrous nature of its roots not admitting the running down much into the soil, there may be danger of its being destroyed in dry summer-seasons; but, as it abounds greatly in the best pastures, and is a blade-grass, that shoots up the first after the land has been mown, its thickest tufts affords much food for sheep in the time of snow and severe weather in the winter-season. Those who are not accustomed to distinguish the difference of grasses with much accuracy, may, it is observed, despise it, as of an improper and useless kind; but the sheep and the ox, who must be allowed better judges, will soon convince them of its importance. From the rapidity of its growth, it may be apt to get coarse, if not cut down more quickly than is often the case. The seed is small and fine, but may be obtained with much facility by passing the stem in a tight manner through the hand. It has been procured at sixpence the quart in some places. See *Cynosurus*.

DOKE, a term applied to a deep furrow.

DOLE, a long narrow slip of green in an arable

field, which is left unploughed; or a piece of land upon a heath or common, of which only one particular person has a right to cut fuel. It is sometimes written *Dool.*

Dole-*Stone*, a term applied to a land-mark or boundary-stone.

DOLPHIN-*Fly*, the name of an insect very destructive to beans. See *Beans.*

DONKEY, a word used to signify dampish or wetish.

DONKY, a word provincially applied to the ass.

DOO, a word provincially signifying a pigeon or dove.

DOOL, a word signifying the same with dole. See *Dole.*

DORMAN, a term applied to the beam of a chamber floor.

DOSOME, an epithet applied in some places to such beasts as improve very rapidly. Thus, a thriving beast, in the northern counties, is said to be a dosome beast.

DOSS, a provincial word signifying to strike with the horn, or gore slightly, as cattle frequently do each other.

DOWLED, a term signifying flat or dead, as in liquor that has lost its head.

DOWLER, a term provincially signifying a dumplin.

DOWN-DINNER, a term provincially applied to the afternoon luncheon.

DOZZAND, a term provincially signifying shrivelled, not plump and fair.

DRAG, an implement of the harrow kind used in breaking down and reducing land into a fine state.

Drags, a name given in some counties to the heaviest kind of harrows. See *Harrow.*

DRAFFE, a term sometimes given to malt-grains. See *Grains.*

DRAIN, a channel or trench cut in the earth, in order to carry or drain off superabundant moisture.

The size of drains must of course be different according to circumstances, but should chiefly depend on the nature of the soil or land, and the quantity of water they are designed to convey; and the number and direction of them on that of the springs, and the situation of the ground in regard to drainage-level.

It is observed by Mr. Johnstone, in his account of Mr. Elkington's method of draining, that in hollow surface drains the depth must always vary, according to the nature of the soil, the situation of the field, the expense the farmer is willing to incur, and a diversity of other circumstances. Many years ago, says he, three feet was the common depth in most soils; but for twenty years past they have seldom exceeded thirty or thirty-two inches; and the number that are cut to only twenty-four or twenty-six is much more considerable.

Main or receiving drains are always, he says, made a little deeper than the others, having more water to convey, and farther to carry it. The deeper they are dug in pervious soils, the further they will operate in reducing the moisture to a level, where it can less injure vegetation; but when the spade reaches an impervious soil, through which water will not percolate, there is no occasion for making the trench any deeper. A few inches, however, in the clay may be necessary, as a safer channel for the water is thereby provided, which is of advantage.

One general rule, he observes, is never to be departed from, which is, that the depth must be sufficient to prevent the impression of the feet of cattle from affecting the position of the materials used in filling them. This must be particularly observed of horses walking in the furrow while ploughing, as they then tread four inches, and perhaps more, below the surface of the ground; add to these four inches, nine or ten more for the materials; and when the drains are only twenty-four deep, there will be nine or ten inches of soil to bear the weight of the horse in the act of ploughing. This, as the earth has been stirred, seems certainly too little, and should apparently ascertain that twenty-four inches is by no means a sufficient depth. If by going thirty inches down, a tenacious soil is not too deeply entered, a greater depth in a more porous one is, he thinks, not only requisite, but ought to be greatly preferable.

In all the modern drainages in the eastern counties, he says, the farmers have been very solicituous to cut them as narrow as possible, by which means a great saving is made in the materials used for filling them, such as bushes, poles, spray, or straw; but if bricks or stones are used, of course this rule cannot be adhered to. However, there is no occasion, he thinks, for the width being greater than one foot, if the stones are only coupled at bottom, or thrown in promiscuously, or more than sixteen inches if laid in form of a conduit. Whatever the depth of materials be, the mould that covers them to the surface should never be less than one foot thick, or rather more, in all tillage-fields. In pasture-land, gravel, if at hand (especially if the soil is very tenacious), is preferable to the mould thrown out, which may be spread on any adjoining hollow.

The depth and width, &c. marked in *pl.* XXII. is the proportion that ought, he thinks, to be adopted on all land that is wet from surface water, or from its stagnation in a porous upper soil.

In the digging of hollow drains there is, he says, a material difference, in the truth and accuracy with which they are executed, according as a workman is accustomed to the business, and skilful or awkward in handling his tools. The work is almost universally done by measure, at so much a score rods; which, as in similar cases, induces the men to earn as much as possible: they require, however, close attention, to see if they keep to the depth contracted for, and that they deposit the earth so as not to fall in, in the act of filling, especially as the surface soil should, on one side at least, be kept

clear from the clay, or lower-stratum. In filling, more attention is necessary, if the work be done by contract, as will be afterwards more fully explained.

Drains are commonly known, Mr. Donaldson says, under the names of covered and open drains, according to the particular circumstances of each. The former of which is chiefly made use of for intercepting and carrying off the water that descends from the higher grounds, or such floods as overspread the fields, in consequence of long continued falls of rain, differ more from each other in size than in form. The covered drains, on the other hand, differ almost in every district, and not less in the size and form than in the materials of which they are formed.

Drains are formed with different materials; such as bricks, free stone, land-stone, wood, sod, peat, straw and heath, or ling; or they are simply open drains, pits, and furrows.

In many districts, Mr. Donaldson observes, where stone is difficult to be procured, bricks are frequently used for making drains. Sometimes bricks of the usual form are employed; two or three being laid at each side, one above the other, and others lengthwise across. In some places, bricks of a particular form are moulded for the purpose. When for small drains, they are formed in the shape of an arch, and placed one by the side of the other in the bottom of the drain. When the drains are meant to convey a considerable current of water, the bricks are made broad at the base, and taper up on one side (that which is placed next the sides of the drain), till about half the breadth of the base. This last-mentioned sort is placed in regular lines on each side of the bottom of the drain, and are covered over with broad flat pieces of free-stone, and afterwards, as in every other case, the remainder of the drain or ditch is filled up with the earth which had been formerly dug out. Drains made of bricks have, he observes, their advantages and disadvantages. They answer best in soils naturally dry, such as lie on an under-stratum of gravel, and where the chief design of the drain is to carry off water arising from springs in particular parts of the field. Rain-water falling on such soils sinks very rapidly, and in few cases obstructs or injures vegetation; but in these soils where rain-water sinks more gradually, and where of course drains are necessary, for the double purpose of carrying off water arising from springs, and that which lodges in the soil and oozes out at the sides of the drains, the bricks in these drains being closely placed together, do not give such a free passage to the filterings from the sides of the drain as those formed of stone, in the ordinary way, are calculated to do. This mode of draining is, however, very effective, but attended with much expense. The bricks employed for this purpose are made in different forms, many of which are represented in the plate on Draining-Bricks. See *Draining-Bricks*.

The drains formed of stone, he says, vary considerably; sometimes owing to the differences in the materials of this kind which are employed, and frequently to the practice of particular districts, in regard to the manner of placing this sort of materials. In filling up drains, where small stones collected from the adjoining lands are used as a means of preserving a passage to the water, there is no material variation in the practice of any particular district from that of others, nor is much attention any where bestowed in regard to the manner of placing these materials. They are usually thrown in promiscuously, to the depth of about eighteen inches; and being covered with straw, fern, or rushes, the remainder of the drain is filled up with earth. In some places, a method which appears extremely well calculated for preventing the interstices between the stones from being choked up with sand or gravel is adopted, that is, placing a layer of long broom, rushes, &c. in the bottom of the drains before the stones are thrown in. This, in all drains which have considerable declivity, must be attended with good consequences, especially if there is a current of water, as it is apt to break up the bottom of the drain, and to carry the sand or gravel along with it, till, being obstructed in the passage, they lodge, and by degrees stop up the course. If drains of this description are filled to a proper depth with small stones, about the size of a man's fist, and a layer of straw, rushes, &c. spread both below and above them, so as to prevent the intermixture of earth, they must, he thinks, not only be more durable, but the water in its passage less liable to interruption than in any other that are formed of stone.

Another method of constructing drains of stones collected from the land, is to select the largest and broadest of them, and to place them triangularwise in the bottom, leaving a small vacuity in the middle for the water to run. When the stones best suited for the purpose are placed in the manner now mentioned, small stones are laid over them to the usual depth, and over them again straw, earth, &c. As this sort of drain is calculated to give a more free vent to the water, it may be considered as an improvement on the other method, wherever any regular and constant stream is expected.

In Essex, and the other eastern counties, Mr. Johnstone observes, that hollow drains are filled with stones from gravel-pits, or gathered off the fields. Very small stones do not, he thinks, answer well for any but very short drains, in which little water is conveyed; and any size requires a greater width at bottom than wood or straw, and consequently renders the expense of cutting greater. Whether the stones are large or small, they should be very clean, and free from any clay or earth that may adhere to them; and put in carefully, so as not to tumble down any of the earth of the drain, which might be apt to choke up the interstices betwixt them.

There are two methods, Mr. Donaldson observes, of forming drains with free-stone, which are materially different from each other. The first is to build two narrow walls, one in each side in the bottom of

the drain (which in such cases is made considerably wider than when land-stones only are used), and to connect these walls by a cover of stone on the top. The size of the open part of the drain, when thus finished, is about eight or ten inches in height, and six or eight in breadth. When small land-stones can be procured, they are laid above the cover of the free-stone to the depth of ten or fifteen inches; and a layer of straw, rush, &c. or of turf with the green side downwards, being placed over the whole, the earth is then replaced.

The other kind of drain, constructed with free-stone, seems extremely well adapted for the purpose of drainage, when the filterings from the subsoils, as well as the runnings from the spring, require free passage. Two flat stones are placed edgewise, one edge of each coming into contact with the other at the bottom, and the others resting on the sides of the drain: on the top of these are laid horizontally other flat stones by way of cover. This sort of drain, when properly made, has a resemblance to the letter A reversed, and not only affords two courses for the water from the main spring, but also gives free admission to that which oozes out at the sides from the subsoil. A drain so formed will bear any pressure that it can be subjected to; and for the double purpose above-mentioned seems, he thinks, as well calculated as any other that can be formed.

This mode of making drains has been successfully followed by Sir Henry Fletcher, in performing which, on grass-lands, he digs twenty-two inches deep. The first spit is of the turf, which is dug carefully out, and preserved unbroken, grass side up, along one side of the cut: then, with a very strong spade, eighteen inches long, six inches wide at top, and two at bottom, he digs a spit in the clay, which the men spread about the land on the side of the drain, opposite to where the turfs were laid, as far as possible from the drain, so as none may get in again. A scoop to clear out the fragments in the bottom follows, which are also spread in like manner. They are then ready for filling: and in doing this, he takes three stones of a thin flat form, as noticed above; two of which are placed against the sides of the drain, meeting at bottom, and the third caps the other two, as represented in *pl.* XXII. *fig.* 3. Thus a hollow triangular space is left to convey the water, which is subject to no accidents that can fill it up, or impede the current. Stones always sink deeper in the ground; and, in the common method, this frequently causes stoppages, by their being partly buried in the clay: but the triangular drain, when it subsides, does it regularly, and keeps its form and passage for the water clear. One cart-load of stones, in this way, will do a considerable length of drain. They are carefully laid down by the side of the cut, with a shovel or basket; and if there are any small refuse stones left on the ground after the drain is set, they are thrown in above. The stones being thus fixed, the sods are laid on them with the grass side downwards, and none of the clay used in filling up. The expense is a halfpenny per yard, the men earning 2*s.* and 2*s.* 6*d.* per day.

It is always necessary, it is observed, to survey them twice; first when the drains are opened, to see if they are of the proper depth; secondly, when the stones are set before the sod is laid in.—In regard to the distance necessary from drain to drain, Sir Henry tried them at ten yards; but the spaces in the middle between them were not sufficiently drained. At five yards asunder they were perfectly effective in the most retentive soil; at six answered well: but he found that they would not operate a cure any where if more than seven yards asunder. Drains made in this manner give, after many years, no sign of failing, and will probably last for a very long period.

The English acre being 4840 square yards, the nearest square of that is seventy yards; which drained at seven yards distant is ten drains of seventy yards each; consequently, there is 700 yards of drains in an acre, or 100 roods of seven yards each, which at a halfpenny a yard is 1*l.* 9*s.* 2*d.* per acre. When this is the price, the stones are half a mile distant: if further off, an allowance must be made for the extra cartage; or, when the ground turns out stony, hard, and ill to dig, a farther allowance is likewise necessary.

These kind of stone drains are more expensive than where the stones are thrown in promiscuously; but they are the only ones applicable to springs, which may thus be prevented from injuring large tracts of land by cuts comparatively short.

The practice of forming drains of brushwood, sod, straw, heath, and other similar materials, is by no means, Mr. Donaldson says, generally adopted; but as some places are but very indifferently supplied with the best material (stone) for draining, the practices of such districts as must have recourse to other means for getting free of superfluous water, merit particular notice.

Drains formed of wood are very common in Suffolk, Essex, Hampshire, and many other districts, and are constructed in the following manner: A drain from twelve to fifteen inches wide is in the first place formed to the depth of ten or twelve inches; and when the loose earth at the bottom is taken out with the common spade, the labourer using one not exceeding three or four inches wide, tapering nearly to a point, makes a narrow cut to the depth of six or eight inches more; and the loose soil at the bottom being taken out with a kind of scoop, bent and formed for the purpose, the labour of forming the drain is completed. Then willow, thorn, or any kind of brushwood, as the boughs of trees, &c. is cut into lengths of twelve or fifteen inches, and laid to the depth of several inches, according to their strength, across the top of the small drain, and made to rest on the sides or shoulders which constituted the bottom of the larger drain before the narrow cut was made. By this means a clear passage, six or eight inches in depth, and from two to four inches wide, is left for the water. The brushwood being properly placed, and to

a regular thickness, is covered with a layer of straw, to prevent the earth, when replaced, from falling into the gutter below. This may appear to some as a very superficial mode of draining; when compared with drains made of stone it no doubt is so; but it is surprising, he says, how durable, and, in many instances, how effectual, they are. He was informed, in the county of Essex, that instances are there very common, where drains of this sort have been known to last upwards of thirty years. Much of their durability is understood to depend on using green new-cut wood, in place of that which had been allowed to remain so long exposed to the influence of the weather after being cut, that the natural sap is dried up. As this is a cheap, and, when well executed, an effectual mode of draining, and durable beyond the period in which farmers in general acquire what may be called a permanent interest in the success of drains on any farm, it may be for the interest of those who possess short leases, and where stone is not to be had without an extravagant expense of carriage, to use wood, as being for that purpose next in durability to stone or brick.

Upon the subject of filling drains with wood, the following observations are made by Lord Petre: The drains filled with wood and covered as usual with straw or rushes, are preferable to stones or any other kind of materials; the reason is, as the wood decays, the water continues to pass. When filled with stones, and the drains stop up, which must be expected to take place in time, the earth becomes quite solid round the stones, and, as they do not decay, the filtering of the water is for ever obstructed. Not so when bushes or wood are used; continual filtering and draining are then for ever to be perceived; and by repeating the operation a second time, cutting the drains transversely of the old ones, the benefit of the filterings through the rotten wood is secured, and the casting up of old broken and damaged drains corrected and carried off. Moreover, as bushes form a much greater number of cavities than either stones or poles, they are less able to stop up, and encourage filtering more than larger and more solid bodies. A load of bushes, containing one hundred and twenty faggots, will, he thinks, do about three hundred and sixty rods; and a load of straw, containing one hundred and twenty bottles, the same. The load of bushes is generally worth about 14*s*. and the straw 18*s*. per load. He therefore calculates this expense at about 12*s*. per acre, ditches a rod apart. Mr. Johnstone remarks also, that Richard Preston, Esq. of Blackmore, a correspondent of the Board of Agriculture, prefers, on twenty years experience, black-thorns to every other material for filling drains.

There is also, he says, another method of filling drains with wood, which is by suspending the faggots or bushes upon cross billets, set on end in the bottom of the drain, as represented in *pl.* XXII. *fig.* 5. This kind of drain has been successfully practised in Berwickshire, where it is said to have continued running for thirty years. It has also been attempted at Livingston, the seat of Sir W. Cunninghame, but is not approved of there; for it is said that the feet of the cattle, in ploughing, went down and deranged the billets that supported the brushwood, and consequently put a stop to the discharge of the water; but this has been owing to the want of sufficient depth of earth above the wood, which was not more than six inches. This kind of drain is, however, much recommended by the writer of the Agricultural Report of the County of Caermarthen in Wales, who says, that the completest method he has yet known is to cut the strongest willows, or other aquatic brushwood, into lengths of about twenty inches, and place them alternately in the drain, with one end on one side of the bottom and the other leaning against the opposite side. Having placed the strong wood in this manner, he fills the space left between them on the upper side with the small brushwood; upon which a few rushes or straw being laid as before-mentioned, the work is done. Willow, alder, asp, or beech boughs, are exceedingly durable, if put into the drain green, or before the sap is dried; but if they are suffered to become dry, and then laid under ground, a rapid decay is the consequence. He has seen willow taken out of a bog after lying there thirty years, and its bark was as fresh and sappy as if it had been recently cut from the hedge; and it is well known that beech laid green in the water will continue sound for any length of time. And Mr. Majendie is of opinion, that wood of eighteen years growth is much more durable than that which is only ten or twelve.

Where the soil is of a very tenacious nature, and old sward-turf can be procured, Mr. Donaldson says, it is not uncommon in some districts, where neither stone, brick, or wood, can be easily obtained, to use sod or turf in the construction of drains. This is the case in some parts of Yorkshire and Wales, and in the counties of Nottingham, Buckingham, Essex, &c. The drains having been formed in the manner described when brushwood is used, the sods are laid on the top of the narrow part of the drain, with the green side downwards, and being rammed down as hard as possible, form a kind of reversed arch over the open part of the drain. This is found, from pretty general experience, in the districts above mentioned, to be a very cheap, and, considering the materials, a surprisingly durable method of draining; answering, in pasture-fields especially, all the purposes that the farmer can expect to derive from drains constructed with more labour, and at a much greater expense. They are said to last frequently twenty years and upwards: but the period which it can be supposed they will continue to prove effectual must depend on the nature of the soil and the current of water.

It is observed by the same author, that peats are materials for forming drains, which few people would have thought of. Drains formed with these he believes peculiar to Lancashire, and to have been introduced there only within a short period.

After stating the method of making drains with such materials, which is mentioned in the Lancashire Agricultural Report, he observes that there is no

question but some peats, which, when thoroughly dry, are of a very hard nature, might, when laid in the bottom of a drain, and properly covered up, continue to retain their hard firm nature in some degree like bricks, and might, on that account, be rendered useful in draining lands; but that peats of the common size (rather less than bricks, should, by laying one row of them in the bottom of a trench, prove materially beneficial in draining adjacent lands, appears to the highest degree improbable. It is, however, of the Lancashire method of using peats in forming drains, he says, rather than respecting the propriety of using them, that he entertains any doubt. He has on very many occasions seen peats, which, when dry, were of so hard and durable a nature, that he has no doubt but they would last, when covered up, for ages. Therefore, new as the idea of using peats, in place of brick or stone in the bottom of drains may be, this method may nevertheless be worthy the attention of those who have not access to brick or stone, but who have it in their power to procure a liberal supply of peat.

It is remarked by Mr. Johnstone, that several mosses have been drained in Lancashire nearly in the same manner as with sods, or by leaving shoulders about a foot and a half from the bottom, and laying over these cross pieces of turf or peat, cut into lengths of sixteen inches, and eight or nine inches square, which, after they have been dried by exposure to the sun and air, easily support the loose mould that is thrown in above them, the thickness of which being for the most part from two to three feet. How long these drains in such soft soils may last good, he says, cannot be ascertained, as it is not long since the practice has been attempted.

Another simple mode of making pipe-drains has, he says, been successfully attempted; but that it is better calculated for the purpose of an aqueduct, or conveyance for water, than for drying the soil. A drain is dug to the necessary depth, narrow at bottom, in which is laid a smooth tree or cylindrical piece of wood, ten or twelve feet long, six inches in diameter at the one end, and five at the other, having a ring fastened in the thickest end. After strewing a little sand upon the upper side of the tree, the clay or toughest part of the contents of the trench is first thrown in upon it, and then the remainder, which is trod firmly down. By means of the ring and a rope through it, the tree is drawn out to within a foot or two of the small or hinder end, and the same operation repeated. A gentleman who has tried this experiment says, this clay pipe has conducted a small rill of water a considerable way under ground for more than twenty years, without any sign of failing.

In respect to drains formed of straw, Mr. Donaldson observes, there is probably no other county where straw is the only article used in forming drains, with a view of preserving a free passage to the water issuing from springs, or filtering through the subsoil into the open part of the drain, besides Middlesex. The trench is made of the same dimensions as those formed of wood and sod; and when completed, ropes of straw, twisted by a machine, such as is used for twisting hay that is exported, and in ropes about the size of a man's leg, is laid on the top of the narrow part of the drain; and being thrust down as hard as possible, and the loose earth that falls into the bottom, in the course of the operation, being carefully scooped out by the labourers as they go along, the straw is then covered up with earth in the usual manner.

Mr. Vancouver, in his View of Essex Husbandry, observes, that when the soil is a very close and retentive clay, the drains should be made proportionably near each other, shallow, and filled with straw only, it being totally unnecessary to use wood, or any more durable material, upon land where the sides of the drains are not likely to crumble in. Upon a soil like this, the drains should seldom, he thinks, exceed the distance of three or four yards.

Drains formed in this manner, through the tough and retentive clays, will be found, in a short time after the work is finished, to have formed over the straw with which the drain was filled, an arch of sufficient strength to support the incumbent weight of the soil, and the casual traffic of the field. In twelve or eighteen months it may be observed, that the straw, being of one uniform substance, is all rotted and carried away, leaving a clear pipe through the land in every drain into which the passage of the water may have been much facilitated, by a due attention to the filling of the drains with the most friable and porous parts of the surface the field might have afforded.

The common practice is to tread in the loose straw; but Mr. Bedwell has lately invented a method of winding it into a hard rope, as large as a man's arm, which he forces to the bottom of the drains, and finds from experience (copied successfully by his neighbours) to convey the water off more readily, and to have much longer duration; at the same time the quantity of straw consumed is not increased, and the operation of filling accelerated. After the cattle have picked it over, he finds the straw tougher, and in better order to wind, than when quite dry and fresh. There is a representation at *fig.* 12, *pl.* XXII. of a very simple moveable machine for twisting the straw into ropes.

Heath or ling has likewise been found a very useful article for the purpose of filling drains. Where this material is employed, the drains are formed in the manner which has been mentioned for sod, turf, or straw ones; and the ling or heath afterwards put in and forced well down, the earth is then returned upon it; and as the heath is a material which strongly resists putrefaction, a very permanent drain is formed.

Open drains are frequently found useful in the business of draining.—In low wet situations, Mr. Donaldson observes, they are often formed for the double purpose of carrying off the superfluous water, and of fencing the fields. In all such cases, the size of the drain should depend on the situation of the farm. If the drains of a particular farm be unconnected with those of others, there is little difficulty in regulating their size according to the pro-

bable quantity of water to be drained off, in consequence of floods; but if the drains connect with those of other farms situated at a greater distance from the out-fall, they ought to be made of much larger dimensions than is necessary for the drainage of that particular farm only; otherwise the adjoining lands will be in danger of being overflowed after every extraordinary fall of rain. The lines or directions of the drains must also depend on particular circumstances. Where an opportunity is afforded to line them off in that way, which, in a flat country, is best calculated to answer the purpose of drainage, some longitudinal drains ought always to be made, as being best for conducting off the water; but cross-drains are equally useful for intercepting and gathering it. All fields, where open drains are necessary, ought therefore to be rather broad than long; as although the furrows on a field nearly level are very good conductors of water for a short space, yet they do not answer for conveying it to any considerable distance. There is one general rule in regard to the dimensions of open drains that ought always to be attended to, namely, to make them slope one foot for every foot of depth. A great slope is not so necessary in strong clay soils as in those where there is sand or gravel in the bottom: but in the generality of soils, an adherence to the above rule will be found best calculated to answer every useful purpose; and such drains have also a better chance of standing than those of any other form that is likely to prove useful.

If open drains are to be formed in strong and adhesive soils, where there is an under-stratum of sand or gravel, it will always be found attended with the most beneficial effects, and far surpassing the additional expense that may be thereby incurred, to cut through to these: by that means a complete power of drainage will be obtained; as, if any covered drains are afterwards found necessary in particular parts of the field, these may be opened with a perfect certainty in regard to their utility.

Some few proprietors, although the number is not large, show, he says, a very laudable attention to the draining of their estates; in so far, at least, as to covenant with their tenants that they shall clean out all the open drains on their respective farms once every year, and by a certain day; and failing of which, the proprietors reserve a power of doing it at the tenant's expense. As this is a measure calculated evidently for the interest of both parties, it should be made a general rule on every farm where open drains are found necessary.

The sinking of pits is another mode of forming drains for land.—Some fields are so extremely ill situated, in regard to outfall, or descent for drainage, that it is not possible to free them from water, either by open or covered drains, so as to render them at all times fit for tillage or pasturage. If, in a field so situated, the farmer can discover a substratum of sand or gravel in any part of it, to which, by opening a drain, he can conduct the stagnated water, and if he will there dig a large pit, the evil may be removed, as the water will sink rapidly through the stratum of sand or gravel. Should this answer the purpose, of which, in most cases, there is little reason to doubt, he has only to fill up both the pit and the drain with stones collected from the land; and the improvement will not only be effectual but permanent. This method of drainage, it must be allowed, is liable to one objection, namely, the risk that, by opening a communication to the stratum of gravel through the impervious super-stratum, the evil in some cases may, in place of being removed, be increased by an additional eruption of water. To obviate this difficulty, it is an easy matter to make a trial with the borer before the pit is dug: if there be an appearance of a spring rising, the bore may be easily closed, and a trial made in another place.

A still further mode of forming drains is by the opening of water-furrows.—This is the operation of clearing out that part of the mould which had fallen into the furrows when the seed was harrowed in. It is very effectually done with the common plough, which is not only drawn along the furrows, but also in such other directions through the field as the ploughman's eye can direct as being best calculated to answer the purpose of drainage. There are few minute particulars in the management of a farm, that more clearly denote general attention or neglect, in the conduct of the farmer, than this. If a traveller observe a farm well water-furrowed, and the headlands cut through, so that the water may have free passage in case of any sudden flood, he may be satisfied, without farther inquiry, that the farmer is attentive; and that, if he fail in reaping good crops, the fault is not owing to his general management. If, on the other hand, water be seen lodging in every furrow, and no pains or labour bestowed to remove it, the farmer may be set down as a sloven, and as one who is careless of the consequences that may be expected to result from mismanagement: and yet it is astonishing in how few districts it is considered as a necessary part of the farmer's business to water-furrow his fields after they are sown and harrowed. How little in general do farmers seem to consider, that saving a little money or labour in the performance of so necessary a work is the worst sort of œconomy! The neglect of this branch of the due cultivation of the soil often hazards a crop, even in seasons not uncommonly wet, and must therefore be considered not only an improper saving, but one which, in nineteen instances out of twenty, is attended with very bad consequences.

In order to expedite the business of making drains, in many cases, recourse has been had to the plough. The method practised by Mr. James Young, of Clare, and which he has himself described, in the Annals of Agriculture, from very ample practice, is this: He says, when he has marked the drains in a field (usually a rod asunder), he draws two furrows with a common foot-plough, leaving a baulk betwixt them about fifteen inches wide; then with a strong double-breasted plough, made on purpose, he splits that baulk, and leaves a clean furrow, fourteen or fifteen inches below the surface; but where the depth of soil requires it (for he likes to touch

the clay), by a second ploughing he sinks it to eighteen or twenty inches: it is then ready for the land-ditching-spade, with which he digs, fifteen inches deep, a drain as narrow as possible.

But the method followed by some good farmers, who do not possess ploughs made on purpose for the work, is this: With their common plough, drawn by four or five horses, and usually stirring about four or five inches deep, they turn a double furrow, throwing the earth on each side, and leaving a *baulk* in the middle. This baulk they raise by a second *bout*, in the same manner: then they go in the open furrow twice, with their common double-breast plough, getting what depth they can. After this they shovel out all the loose mould and inequalities to the breadth of about a foot; and thus having gained a clear open furrow, the depth varying according to the soil and ploughs, but usually about eight or nine inches, they dig one *spit* with a draining-spade, sixteen inches deep, thus gaining in the whole twenty-four or twenty-six inches. But as this depth is seldom sufficient, when necessary they throw out another, or even two other spits, which makes the whole depth from thirty to forty inches.

In the filling of drains, there is one circumstance to be attended to, particularly by those farmers who are most solicitous to have the work well performed; and that is, to contract with men only for digging and leaving clean, in order that the filling may be done by men paid by the day, as a greater security that it should be executed with all possible care; and is usually attended by the farmer himself, or some confidential servant. This is a rational practice, and merits being followed. Mr. Young, of Clare, observes in the paper quoted before, that it is an invariable rule with him never to suffer the man who digs to cover up the drain, but it is left open for him or his bailiff to examine; and then it is well filled up to the shoulders with wheat-stubble, cut and stacked for the purpose immediately after the harvest; and a small stick or two at the outlet to prevent its being stopped by any external accident. Lastly, with a common plough he turns a furrow of the upper soil or mould upon the drain, taking care not to turn in any of the dead soil raised by the land-ditch spade, which ought always to be laid on the outside, and scattered over the land. It is right not to let the drains lie open any length of time, lest they get injured by wet or frost: his general rule is to fill them up every day. The different methods of filling with stone, wood, straw, &c. will, however, be better understood by examining the sections in *pl.* XXII.

The expense of drains will of course vary with the soil, depth, price of labour, &c. and these circumstances are so different in different districts, and even in different parishes, that it accounts for the various reports of writers on the subject. The price in Suffolk to dig and fill two spit-drains is from 3*s*. 4*d*. to 3*s*. 6*d*. a score rods, without beer. In the Essex draining, other rates are mentioned, and also the cost of materials used in filling—an article liable to equal variations with the labour. Mr. James Young says, it is not easy to ascertain the price of carting the wheat-stubble to the place where it will be wanted, and stacking it, because the value must depend upon the distance: it is equally difficult to say what the work of the ploughs ought to be valued at; for though several acres may be drawn out in a day with one plough, yet he never chooses to do above two or three hours work at a time: therefore, he leaves every farmer to fix his own price upon these parts of the business, only desiring him to consider, that it is work that will wait for a leisure time; and frequently, if the horses were not so employed, they would earn nothing. He pays for digging the land-drains 1*s*. 8*d*. and for filling them up with stubble, 4*d*. per score rods, without beer. An active man, used to the work, where the soil is not stoney, will dig twenty-three or twenty-four rods in a day, within working-hours. The state of the expense, that is, the money that a farmer will pay out of his pocket for land-draining an acre of land, will stand thus:

For cutting and raking together an acre of wheat-stubble, generally sufficient for an acre of drains -	£.0	2	0
Digging eight score rods of drains	0	13	4
Filling up with stubble -	0	2	8
Extra work with the common spade, on an average a day's work for a man	0	1	4
	£.0	19	4

Lord Petre says, the value of the work of the plough varies according to different people's method. His general method is to plough with a common plough and a pair of horses, two furrows different ways, leaving a baulk in the middle, which he afterwards ploughs out with a larger plough, and three horses a-breast, which will turn a furrow regularly about two inches deeper than the land is generally ploughed. The expense, not reckoning any thing for the master, who he supposes attends, and marks out the ditches, is about 18*d*. per acre: ditches a rod apart. This method is for fallow. The labour of digging is $2\frac{1}{4}d$. to $2\frac{1}{2}d$. per rod; and the expense per acre of the whole work is, as near as he can guess, on a fallow where two spits are digged, 43*s*. 6*d*. per acre; with the plough and one spit, about 35*s*.; on lay with the plough, about 35*s*.; without the plough and the spits set, about 47*s*. per acre.

According to Mr. Majendie, the expense is: digging the drains with the small or last spit-spade, per score yards, 20*d*. to 24*d*.; two spits in main-drains, 3*s*. 1*d*. to 3*s*. 6*d*. In this manner the under-draining one acre (the drains at one rod apart), including wood, straw, and all other incidental charges, amounts to an expense of from 40*s*. to 45*s*.

The duration of hollow drains must necessarily depend on the nature of the materials with which they are filled, and in some measure on the quality

of the soil, as certain species of land have the power of preserving wood or other perishable materials much longer than others. Stones last till accidental causes impede the flowing of the water, and may last for ever. Wood perishes in certain periods, but it does not follow that the drains should stop: if the earth arches, the water will necessarily continue to flow; which is found to be the case when wood, straw, and stubble, are rotten and gone. Drains that have been filled with bushes and straw (both which were rotten) have been observed to run well forty years after making.

On this subject, Mr. Young, of Clare, observes, that he has never been able to ascertain the duration of the stubble with any degree of exactness; neither has he ever drained a field a second time: but a drain will sometimes be stopped by carting on the land in the wet, or some other accidental cause; in which case, as soon as it is discovered by the wetness of the place, his practice is to make one or more fresh drains in different directions to the old ones: and he has many times observed old drains, when cut across, though there was not the least appearance of any vegetable substance remaining in them, but full of loose porous earth, at once run freely, or, according to his workmen's phrase, *bleed fresh*.

During the wet weather, about the middle of April, he examined a field of six acres, which he land-drained in the month of November, a great number of years before, and had the satisfaction to find every drain in the field, except one, running.

In regard to the mode of marking out drains, Mr. Johnstone remarks, that for many years, probably for more than half a century, and possibly during a much longer period, farmers did not make a proper distinction in fields that had a declivity, between tracing their drains *with the slope*, or directing them *obliquely across it*. Large tracts have been drained, or have been meant to be drained, in the former way; and many, even to this day, are guilty of the same error: but the best farmers are now attentive to so important a point, and studiously mark the direction of their drains obliquely. They are also careful to give them just the fall sufficient to carry off the water in a gentle, but not a rapid current, by which means they are less apt to choke, or *blow up*, as it is sometimes called; whereby spots in the field have an artificial spring formed. Upon fields level, or nearly so, great numbers of which are found in the western counties of England, it has been a common practice, and not an improper one, if the wetness proceeds solely from rain, to mark the drains regularly at a rod (sixteen feet and a half), a rod and a half, or two rods asunder, across the land from ditch to ditch: or, if the drains, from any small inequality of surface, will flow only at one end, then to stop short, or discontinue their length on one side of the field, as soon as the ditch operates in laying it dry. Where the slopes of a field vary, and fall in different directions, the farmer should attend to such variations, and direct his drains so as to cross obliquely the upper side of each declivity.

It is a general rule not to conduct too many drains to the same mouth or outlet; for if much water flows in any drain, from having thrown many lateral branches into one main drain, the latter must not only be made larger and deeper, but will even then be liable to fail; and a failure in that case affects so much a larger space of ground, by impeding the course of so many other drains. On this account it has been found better to make the drains detached, rather than to connect too many of them together, which occasions much water to be conducted to one mouth.

Cases will, however, occur, in which, from the position of the ground, it may be found necessary to join several branches (wings) into one main drain. On this subject, Mr. Vancouver, in the Agricultural Report of Essex, has the following judicious remark: If the field proposed to be drained lies greatly upon the descent, every care should be taken to make the drains bear sufficiently horizontally; in the first place, to prevent a too precipitant fall of the water, by which the bottoms of the drains would be worn uneven, and a temporary obstruction occasion them to blow up; and secondly, because the more perfectly horizontal is the field, so that it lies level, free, and affords a sufficient fall for the water, the less occasion will there be for the same number of drains as would be required upon a soil of equal closeness upon the side of a hill—the drains in the field that lies nearly level, drawing equally well on each side; whereas those on the hang of a hill, drawing only from the higher sides of the drains, and consequently requiring them to be made much nearer or closer together.

In respect to the season for executing the business of cutting drains, it is a point on which opinions, it is observed, vary; some preferring winter, and others summer. When a great quantity of work is to be done, all seasons of the year, free from sharp frosts, must be made use of; and this is usually the case when a farmer enters on a lease to a farm which has not been drained, or which requires to be done a second time. Stubbles are done in winter, and fallows in summer: but when a single field or two are only to be done, the farmer may choose the most convenient season. Many excellent farmers would not do it at any other time than summer, from being then able to execute the cuts in a cleaner and neater manner, and free from that kneading and plastering which takes place in winter, and which they think tends to prevent the flowing of the water from those minute and imperceptible veins and interstices of the soil through which the water percolates. They have farther remarked, that opening the earth in a dry season gives a tendency to drain it, as the particles of the soil, after being separated and well dried, will not so easily unite again; whereas the kneading in winter tends to increase tenacity where it is most to be avoided. Farther, that carting on the fields in winter, to bring on stones or other materials, is more difficult and dangerous than in summer. In opposition, however, to these ideas, Mr. Young, of Clare, in Suffolk, it is remarked, is of

a contrary opinion. He never land-drains, he says, in summer: two inconveniences attend it; the increase of labour, in a clayey soil, when hard and dry, is very considerable, and, the want of leisure, and when good labourers are scarce. The want of labourers, in some places may, it is observed, be an unanswerable objection, but the dryness is not: for, if previous furrows, opened by the plough, or last course of ploughing on arable-land, be not left too dry, but the spades follow directly, after a little rain there will be moisture sufficient to make it work freely. Many good drainers prefer executing the work when the land is under a *layer*, that is, sown down with grass. Lord Petre on this observes, that the plough for opening the previous furrows works better on a layer. He prefers a lay, if *layed* down level, as he has a plough on a very simple construction, with which, and six horses, he can plough from ten to twelve inches deep, and lay the furrows as regular as a man can with a spade; so that, after the ditch is digged and filled, the furrow can be put into its place again, and rolled down with a large roller quite level; and then he digs but one spit with the bottom land-ditching-spade fourteen inches deep: the expense 2*s.* 8*d.* per twenty rods, the digger returning the furrow to its place. He also uses this plough on fallow; but it does not answer so well, as the moulds fall into the furrows. The expense of digging on fallow is 1*s.* 2*d.* per rod.

When the ground is in summer fallow is certainly the best time for casting drains that are only for carrying off surface-water, as the distinction betwixt the wet and dry parts of the field is then easily perceptible, and any prominent inequalities of surface may then be more easily levelled or reduced, by paring off the heights and adding to the hollows.

All the above sorts of drains may be defined under the following heads:—

Arched Main-Drain, is such a drain as has a sort of arch turned over it in mason's work. They are in general much too expensive to be employed in any situation, except as large discharging-drains, where the ground is loose and porous, or where open-drains cannot be admitted, as in pleasure-grounds, or to convey off water from deep well-drains. Where stones of the flat kind can be readily obtained, these drains may be formed of them, especially where the quantity of water is not too great.

Brushwood-Drain, is such a drain as is filled with wood of the brush or twig-kind. It is observed by Mr. Marshall, in his work on Landed Property, that "where the offending water lodges in the subsoil, and this rests on a firm base, wood may be used with lasting effect. For if the part of the trench, which operates as the drain, be cut out of the firm stratum, and the wood be smoothly covered with straw or rushes, and the firm clods, raised out of the trench, be laid upon this smooth covering, a regular arched-pipe will be formed; and, as the wood decays, a hollow earthen drain will take place." In these cases, says he, "why not form them in a better manner at once; and thus prevent much trouble and expense, and avoid the waste of faggot-wood and straw."

It is conceived, that "where the water lies in a loose and deep stratum, so that the operative part of the drain is necessarily formed in loose ground, brush-wood is a mean material; and its effects are of short duration. For as it decays and shrinks, the sides of the trench shoot in; and, in the course of a few years, the drain becomes choked; the land being thus rendered worse, perhaps, than it was before the operation of draining was performed. Whereas, in such a situation, a drain, properly formed, and properly filled with hard materials, which are not liable to decay and shrink, but which, when once they are fixed on a firm foundation, support the sides of the trench and remain unchanged by time, may be deemed perpetual: nothing but neglect, or accident, can prevent its freeing the soil from superfluous moisture" or wetness.

The various sorts of materials that have been employed in this way, have been shown above. But the able writer, just mentioned, says, that "the hard materials, which are most generally in use, are pebbles, and other small stones, picked off ploughed-grounds, collected in river-beds, &c. The rubbish of stone-quarries, and coarse stones broken down into fragments, are also equally eligible." And he adds, that "seeing the apparently imperfect channels in which water is found circulating, naturally, there can be little doubt of rough well-skreened gravel (properly raked or run into trenches, so as to bury the roughest at the bottom) being sufficiently effective. In deep clayey districts, where stones are difficult to be procured, the rubbish of brick-kilns, or dried lumps of clay, sufficiently burnt to prevent their being re-softened by moisture, would, he apprehends, be found (in cases where the sides of the trenches are too tender to stand firmly without some support) the most eligible materials. Although, in such a situation where tough wirey sward is generally plentiful, the hollow sod-drain, as shown in *pl.* XXII. would be the cheapest. And the form of the trench, for the filled drain, is there also seen.

He further states, that "its dimensions should vary with the required depth, and the quantity of materials intended to be used. The width at the top should be about one-half of the required depth. Thus, a trench which is required to be dug thirty inches deep, ought to be set out fifteen to eighteen inches wide; and one of three feet deep, eighteen to twenty inches wide; in order to give room to the workman, in digging the lower part. The width at the bottom may be regulated by the plentifulness, or the scarcity, of materials. In ordinary cases, from four to five inches may be deemed the most eligible width. Where materials are scarce, less than four inches may suffice; where they are plentiful, more than five may be allowed. For it is observable, he says, that, with every care, some earth will wash down among the filling materials, and subside at the bottom of the trench; where, there being no free current as in hollow drains, it lodges:

and it may be said, that the more room it has, there, the less injury it will do to the drain. If, however, the trench be sunk a few inches beneath the lodgement of the water (as it ever ought to be, where circumstances will admit) every probable injury of this kind may be avoided" and guarded against.

Where "the foundation of the filling materials (the bottom of the trench) is not sufficiently sound to bear their weight, and prevent their sinking into the mire below, it must be strengthened by a bed of heath or brushwood, or a flooring of tough thick turf (as before directed) to hinder the mire from rising up among the materials, and fouling the drain." And with respect to the depth of materials, it "ought to be regulated, he says, by given circumstances. If a mere conductor, or artificial vein, to receive water from a natural one, which feeds a quicksand or landspring, be the only requisite, ten or twelve inches of depth is sufficient. But if the intention of the drain is, not only to conduct a small stream of water, but also to collect it from the subsoil, the depth of the absorbent materials requires to be greater; as fifteen to eighteen inches; according to the depth of the drain and the nature of the containing stratum. Where a subsoil is sufficiently open to receive rain-water, without being open enough to let it pass off freely, or where the water circulates in veins at different depths, the absorbent materials of the drain ought to rise to near the soil, or within a foot of the surface: thus allowing a sufficient depth, not only for the operations of the plough, but for the tread of working animals, drawing in the plough-furrow." But it is to be observed, he says, that "where rough materials are scarce, and where clean gravel can be plentifully had, this may be employed to collect the water, and convey it down to the more open materials." And "a covering of some sort is required to be laid over the filling materials; especially if they are of a rough open kind; to prevent the earthy matter, with which the upper part of the trench is to be filled, from being washed down, while yet in a loose porous state, into the operative part of the drain. Heath-rushes, straw, or firm clods (if such rise in making the trench) may be used for this purpose." And "upon this covering, the loosest, worst parts of the excavated earth should be laid; reserving the best of the soil to re-occupy its place, at the surface; rounding it up, a few inches, above the level of the field, to allow for its settling; and spreading the surplus, if not of a very pernicious quality, thinly over the field of improvement. Hence, in digging a trench, it is proper, he says, to separate what rises, according to its qualities; laying the best of the soil, in a line, on one side of it, and the substrata, in heaps, on the other; and separating these, if of different qualities, agreeably to the purposes to which they may be applicable. Without this precaution, he thinks, a drainer has no claim to accuracy of workmanship," or propriety of management.

Covered Subsoil-DRAIN, is such a drain as is formed in the under stratum of the land; and which should constantly vary, according to the nature of it and that of the materials which the particular situation affords. These sorts of drains are either *hollow* or *filled*, according as they are to receive the water and the nature of the materials of which they are to be constructed.

In respect to these sorts of drains, Mr. Marshall says, that "moles are their greatest enemies; especially, perhaps, where the operative parts of them rise to near the surface. These natural drainers of soils (and valuable labourers in cold grass-lands) require, he says, outlets to their drains, to discharge the rain-water which the soil communicates to their runs; otherwise they would be liable to be drowned in their own works, or to be driven from them, in a wet season. Hence we see the sides of open drains, ditches, and rivulets, pierced with mole-holes. Covered drains are equally favorable to their purpose; and doubtlessly are in common use, where moles inhabit the sub-drained lands. In strong loams, which discharge with reluctance the waters they receive, the use of mole-holes, to collect the waters and conduct them to the covered drains, is evident, and in a state of perennial herbage, in which the soil remains undisturbed; there is no counter effect to lessen the benefit. But in a state of tillage, a serious evil is, he says, liable to take effect from the works of moles, not so much by their filling up the drains in making them, as by letting down the foul waters of heavy rains, especially when an outlet of this kind happens to be cut through by the share, and left open by the last furrow, between two ridges; and most especially, where it is an interfurrow of land laid up for a winter crop: as, in this case, the muddy waters of twelve months' rain are let down into the drain, and may choke up a filled drain, in one season." It is remarked, that "there are two ways of preventing this evil. The one, by extirpating the moles; and the other, by filling up the holes in the interfurrows, as soon as the crop is sown: an easy operation. The cure is to open the drain, in the injured part, to free the materials from the soil, and return them again into the trench: a work of no great labor" or difficulty.

There is another source of injury in *field-mice* to filled-drains. "They not only, Mr. Marshall says, militate against them, in the manner of moles, but make their lodgings, he apprehends, among the rough open materials. In a grass-ground, he has been able to trace the line of a covered drain, by the innumerable burrows, and other effects, of these little animals." And a third source of mischief is in "the roots of trees, and other deep-rooting plants. The willow is a well-known enemy; the ash, too, is spoken of, as being singularly injurious; and he has lately had an opportunity of observing the extraordinary instinct of the elm, in searching for and taking possession of a channel of running water: namely, an earthen-ware conduit, of two or three inches in diameter,—into which one of its fibrils had insinuated itself, probably in a hairlike form; yet had, in a short time, completely filled up the pipe

with a bundle of fibres (in the shape of a fox-brush, but much larger) so as to stop the passage of the water. Hence, he thinks, all trees (the oak perhaps excepted) ought to be avoided, or eradicated, by the conductors of covered drains," in all situations.

Filled-Drain, is such a drain as is formed by "trenches partially filled with stones, brushwood, or other rough open materials, to admit and give passage to subterrene waters; the upper parts of the trenches being refilled up with the excavated soil: thus forming, in effect, an artificial subsoil,—absorbent, and open." It is suggested by Mr. Marshall, that "the first drains of this description were probably formed with three poles, laid triangularly, at the bottom of the trench. Of later years, brushwoods, as the boughs of trees, and hedgewoods, have been much in use;—the larger branches being placed at the bottom, and covered with the spray. But, in more modern times, these have given place to stones, and other hard materials, in almost every country and district, in which draining has been long practised, and hard materials are easily procured," as being better for the purpose.

Hollow Earth-Drain, is such a drain as is formed with earthy materials. This sort of drain may be found useful and effective, Mr. Marshall says, "where a basis of firm clay, or strong loam, is situated beneath an absorbent subsoil, and at a convenient depth, as from twenty to thirty inches beneath the surface, being grooved out of the base, and formed with earth alone, at a comparatively small expense, even where stones or bricks are plentiful. They may be employed with effect, either to collect water from the subsoil, or to receive rising waters through perforations at their bases. In forming them, a wider trench having been sunk through the soil and subsoil, if any, a narrower groove is, he says, formed in the base, leaving a flat even shoulder, or shelf, on either side of it. On these shoulders the inverted turf, raised at the top of the trench, or collected in making surface-drains on old grass-lands, and cut five or six inches thick, is laid as a cover to the groove; and upon this the excavated muold of the trench is returned." And, in regard to "the dimensions of a drain of this sort, they may be these:—the bottom of the trench ten or twelve inches wide,—the top of the groove five or six inches, narrowing to three or four inches at the bottom,—its depth five or six inches. As the turf decays, the middle of the cover molders down, and forms an arched roof to the open drain, which thus acquires an oval form." It is added, that "if, in forming a drain of this construction, the bottom of it cross, or touch upon, a vein, or a stratum, of loose earth, as that in which the water more particularly lodges, it is necessary to line the pipe, or operative part of the drain, with turf, to prevent the sides from shooting in, and thereby choking up its channel. In performing this more difficult part of the operation, the wider trench is to be continued down to the bottom of the drain; and if this also require to be strengthened, a few inches lower, to receive a floor of turf. On this floor, ten or twelve inches wide, two lines of sods are set on-edge, and leaning somewhat outward, so as to answer the form of the groove; and are firmly fixed in their places, by the covering turves, as seen in *pl.* XXII. The joints on every side are to be left sufficiently open, to permit the waters to filter freely into the trenchlet or pipe of the drain, and close enough to prevent any grouty matter from entering it," and filling it up.

Hollow Stone-Drain, is such a drain as is hollow, and constructed of stones. It has been stated by Mr. Marshall, that "in districts where thin flat stones abound, and in cases where the subsoil is deep, and of a loose friable texture, square walled drains, formed with wide flat stones laid at the bottom, a dry wall raised on each side, with refuse splinters of the same rock, and covered with flat stones at the top, as seen in *pl.* XXII. are eligible. They are expensive; but efficient and durable. The dimensions of those which he has examined, he has found greater than may seem to be necessary; namely, about eight inches wide, and six inches deep. It is to be observed, however, that the larger the dimensions are, the more capable the drains will be of imbibing the adjacent waters, and the less liable to be warped up. If a drain of this sort be conducted along a firm basis, and with a moderate descent, the flooring is not required." It is remarked, that "in Devonshire, where thin flat stones and rough pebbles are equally plentiful, it is common to place the former, trianglewise, at the bottom of the trench, as seen in *pl.* XXII. and then to fill in, above, with the latter: thus forming, at a moderate expense, a drain that is equally adapted to waters rising at the base, and those which are collected from the subsoil. They are much firmer, and less expensive, than the more common square drains that are formed with two side-stones, set on-edge, and a wide flat covering-stone, which form an unstable fabrick, compared with a triangular drain." It is further stated, that "hollow drains may also be made of common bricks, but generally at a great cost. This has led to the invention of draining-bricks, in various forms. And, in a country where clay is plentiful, and stones are scarce, they may be profitably used. In places where manufactories of draining-bricks are not established, and where the length of drains required is not great, a flooring of common plain-tiles, and, along these, a line of common ridge-tiles, would form an efficient channel for almost any purpose of working drains. Where water is to be collected from a subsoil, which, though absorbent, parts with its superfluous moisture reluctantly, and where pebbles are wanting, a covering of clean rough gravel, or other hard and open materials, would be found useful in this as in every other species of hollow draining." See *Draining-Bricks*.

Hollow Subsoil-Drain, is such a drain as is formed in the under soil not filled. It is observed by Mr. Marshall, that "in cases where the water is to enter the drain at its base, as in those of rising waters, hollow drains are preferable to those which are filled, especially where the borer has been used,

as the water immediately finds an open channel to receive it. Mr. Elkington recommends, in difficult cases at least, to bore by the side of the drain, not in the middle of the floor. If the bottom of a drain, which is perforated on the side, were made hollow, or dishing, not flat, the mouths of the bores would be out of the way of the current of the water. If the bottom of a drain be not firm enough to sustain the current, common pan-tiles would make an eligible floor for a perforated trench." And it is added, that "where the drain is to collect the water at its sides, from the stratum in which it is formed, a depth of absorbent materials may be required; and, here drains of less expense will generally answer the desired end. In cases where rising and descending waters are to be received, the two kinds may be profitably united" in many instances.

Mole-Drain, is a small sort of pipe-drain, made by an implement for the purpose, "a foot or more beneath the surface, by the means of a thick iron spike, pin, or bolt, drawn horizontally, at that depth." It is supposed, that "for cold retentive grass-lands, which lie too flat and swampy, to shoot off readily their surface-waters, and which are free from stones, the mole-plough will perhaps be found of general benefit; but most especially, Mr. Marshall conceives, for moist sheep-pastures. There is much merit in the thought, and the construction is beautifully simple. The great strength and weight of draft which is required to work it, appears, from what he has seen of it, to be the principal objection to its use." This has, however, been lately obviated by working the tool by means of a windlass turned by women. See *Mole-Plough*.

Open-Drain, is such a drain as is not closed on the upper part. It includes surface-drains of all kinds, from the interfurrows of lands under the plough, and the shallow trenches or cuts of meadow and grazing-grounds, to the common-sewers, or discharging channels of the higher lands, and the more stagnant sewers, or water-fences of low countries. This sort of drain is mostly proper for conveying rain-waters from the surfaces they fall upon, to their natural receptacles. But in taking off water from beneath the soil, they cannot be properly made use of in any other way than as main-drains, to convey away the stream that may be collected. Mr. Marshall remarks, that "operative-drains, if cut to a sufficient depth across the area of a field, to draw out superfluous moisture properly from the subsoil, cannot be left open with any degree of propriety. When water issues, the sub-stratum is naturally loose, and liable to shoot into open trenches, which are likewise exposed to the tread of cattle; so that even in grass-lands they are ineligible, and still more impracticable, he says, in lands under tillage. Even main-drains, if carried across loose ground, require to be fenced on one side, or to be made wide and deep enough to prevent cattle from crossing them."

DRAINING *of Land*, the means of removing or carrying off the prejudicial wetness of land.

In order to perform this kind of business with the greatest economy and advantage, it is necessary to be well acquainted with the stratified conformation of the earth, and the nature and causes of springs; as well as the use of the level and other implements which may be wanted. It is observed by Mr. Johnstone, in his account of Mr. Elkington's methods of draining land, that it is remarkable that the principles on which the draining of land depends, being so great a desideratum in agriculture, should have been so little known or attended to; or that the practice of it, according to these obvious principles, should have been so much confined, while improvements in the other branches of husbandry have been carried almost to the highest possible perfection:— But that, however intricate or abstruse it may hitherto have been considered, even by those who were otherwise well informed in the theory of agriculture, of which it forms the most important branch, it will appear, from the following observations, to be founded on circumstances the most plain and rational, and which, when reduced to practice, produce thost effects which a simple knowledge of the cause naturally points out. Wetness in land proceeds, he says, from two causes, as different in themselves as the effects which they produce. It proceeds either from rain-water stagnant on the surface, or from the water of springs issuing over, or confined under it. On clay-soils that have no natural descent, wetness is commonly produced by the first of these causes; but in a variety of situations it may proceed from the latter. But the principle of the art is so closely connected with the nature of springs, that without a knowledge of these, and the causes producing them, it is impossible to practise it with either success or advantage; for surface-draining, when the wetness proceeds from subjacent water, is only alleviating the effect in place of removing the cause. It will therefore be necessary, in the first place, so far to ascertain the nature of springs, and their connexion with the formation of bogs, as to enable the practical drainer more easily to comprehend the theoretical part of the system. From its general external appearance, and by the perforations that have been made in it by quarries, wells, and other subterraneous pits, the earth is known to be composed of various strata, which being in their nature of opposite consistence, are distinguished by the names of *porous* and *impervious*. Those strata which from their more open composition are porous, and capable of receiving the rain-water that falls on them, include rock, gravel, sand, and such marls as are of an absorbent quality. Clay, and a certain kind of gravel having a proportion of clay in its composition, which, by binding and cementing the small stones together, renders it equally close and tenacious as clay itself, with such rock as is of a close and compact nature, without any fissures in it, are the principle strata that resist the reception of water, and that are capable of retaining it on their surface till exhausted by the sun, or carried off by suitable drains, and are termed impervious.

Springs, therefore, according to him, originate from rain-water falling upon such porous and absor-

bent surfaces, and subsiding downwards through such, till in its passage it meets a body of clay or other impenetrable substance which obstructs its farther descent; and there forming a reservoir, or considerable collection of water, it is forced either to filtrate along such body, or rise to some part of the surface, where it oozes out in all those different appearances that are so frequently met with. This is evident from the immediate disappearance of the rain-water as it falls in some parts of the ground, while it remains stagnant on others till carried off by evaporation; and from the strength of springs being greater in wet than in dry seasons. Hence, after incessant rains, they are observed to break out in higher situations, and, as the weather becomes drier, give over running out, unless at their lowest outlets. The strength of springs, also, or the quantity of water which they issue, depends chiefly on the extent of high ground that receives and retains the rain, forming large reservoirs, which afford them a more regular supply. Thus, he says, bog-springs, or those that rise in valleys and low situations, are much stronger, and have a more regular discharge, than those which break out in higher ground, or on the sides of hills.

But, independent of these causes, there are, he observes, certainly great springs contained in the bowels of the earth; otherwise, how could the many rivers that intersect it be supplied with such vast quantities of water as they discharge, the rains falling on its surface, or the dews that descend not being adequate for that purpose? But as this may be considered among those arcana of nature which have not yet been sufficiently explored, and lying at too great a depth to affect the surface, it comes not within the limits of the present inquiry. With the nature and causes of springs, that of bogs is intimately connected; for where springs, breaking out in the manner above described, run over a flat surface of clay, and cannot get off with sufficient rapidity, or are not confined to a narrow channel, the superabundance of water must cause the dissolution of all the coarse vegetables it produces, which, together with part of the natural soil itself, is formed into a peat-earth, every year increasing in depth; and the extent of such bog or morass is according to the quantity of water, and to that of the flat ground on which it is formed. The great object of the present system is, that of draining such bogs, by cutting off entirely the source of the springs, or subterraneous water that causes the wetness, either by flowing over the surface, or by its being long confined under it. If the springs have a natural outlet, the object of the drains is to lower and enlarge it; which, by giving the water a more free channel, will sooner discharge and draw it off, or will reduce it to a level so far below the surface as to prevent its overflowing it.

Where the springs have no apparent outlet, but are either confined so far below the surface as to injure it by constant moisture, or by oozing out imperceptibly through any small pores of the upper soil, the object of the drain is to give a proper vent to that water, and to extract more quickly and more effectually what has before been pent up in the bosom of the soil. The object of the auger, which in many instances is the *sine qua non*, or only means of performing the business, is simply to reach or tap the spring, and to give vent to the water thus pent up, when the depth of the drain does not reach it, where the level of the outlet will not admit of its being cut to that depth, and where the expense of cutting so deep would be very great, and the execution of it very difficult. But as the whole depends upon the situation of the ground to be drained, and the nature and inclination of the strata of which the adjacent country is composed, as much knowledge as possible should be obtained of these before the proper course of a drain can be ascertained, or any specific rules given for its direction or execution.

The nature and effects of different strata have been further shown by Mr. Marshall in his valuable work on Landed Property, where he observes, that "the earth is composed of materials infinitely varying in quality and arrangement. But as they relate to the subject under notice, they admit of a two-fold division. They are either absorbent, or non-absorbent: they are conductors, or non-conductors of water." But that "of the latter distinction, (if we except rock without pores or fissures, which, in this country, is not commonly met with, in situations, and of a sufficient extent, to entitle it to general consideration, here—unless in a few instances that will be noticed) we have, he says, only one species, namely, clay, or a large proportion of argilaceous earth mixed with other materials; and even this is impervious to water, in a state of moistness, only. A clayey soil, in a droughty season, becomes a sieve;—more especially if it is thin, and lies upon an absorbent base. On the contrary, a strong loam, or a soil composed of a smaller proportion of clay with sand or other material, and which, in a moderately dry season, may be considered as a conductor, becomes, when saturated with moisture, and is of a sufficient depth, a non-conductor: or may be properly ranked as such, in the present enquiry." He adds, that "the free conductors of water are light sandy loam, sand, gravel, pebbles, and open and porous rocks, of which chalk is a notable species." This last, he says, "from the uniform texture of it, as well as from the extensive and deep masses in which it is found in this country, presents itself as the most suitable subject to be brought forward, in order to explain the effects of rain-water falling upon land. If the surface of a chalk-hill is covered with a deep soil of clay, or strong clayey loam, as the Kent and Surry hills frequently are, the waters of heavy rains, after the soil is saturated, collect, he says, on the surface, until they form streams which convey them off the soil, and conduct them to the rivulet, the brook, and the river, into which the given turn of surface directs them." But "if, on the contrary, the chalk, as is more generally the case, has only a thin covering of absorbent loam, it imbibes, after the soil is saturated, every drop of rain which falls upon it.

The hills of Wiltshire and Dorsetshire, some particular parts of them excepted, suffer no water to escape from their surfaces, unless during a deluge of rain, or a sudden thaw. He has travelled across them, after a whole night's heavy rain; when the rivers, so far from being swoln above their ordinary height, were not even discoloured! except where the waters of roads entered them." It is added, that "water which is absorbed, by so porous a substance as chalk, soon escapes the power of evaporation; and continues to descend (like that which passes through a filtering-stone) until it meet with a non-conducting stratum. Upon this it collects; and, if the collecting surface lies above the level of the sea, or other collection of waters, forces its way out, in the manner of a spring, or more copious fountain: not always in a constant stream, but often periodically; the springs of chalk-hills differing, in this respect, from those of more open conductors: a fact that is, he thinks, well entitled to philosophical research." It is however remarked, that "the operation of the waters of chalk-hills is most plainly seen on the sea-coast, where the base of a chalk-cliff rests on a non-conducting stratum, which being softened and worn away by the action of the waters collected upon it, the cliff is undermined, and the face of it thrown down. Where the base of the chalk dips beneath the surface of the sea at low water, the whole collection regains its 'native home' unseen. And, doubtless, much rain-water, passing through other strata, finds its way to the sea in a similar manner."

It is supposed, that "deep sandy lands, such as the county of Norfolk is chiefly composed of, form the next simplest subject, for explaining the effects of rain-water falling upon land. Sand being of a more open nature than chalk, and its hills, or more depressed masses, being generally of much less depth than those of chalk, the effect is more quickly produced. 'Presently after a glut of rain the springs fly out.' And there is another difference, more interesting, he thinks, to our present enquiry, between the effects produced by chalk and by sand, as conductors of rain-water. Chalk usually throws it out, from the sides or at the bases of its hills, in clear streams, producing no other effect, on the surfaces of lands, than that of forming channels of conveyance to the rivulet or brook to which the given cast of surface inclines them. The waters absorbed by chalk-hills seldom occasion any thing of the nature of upland-bog, unless when they rise in the area of a flat-based valley, or are obstructed therein, and, by spreading over its surface, encourage aquatic plants. On the contrary, sand-hillocks are, he says, singularly productive of this baneful disease of land: owing, in part, to a want of uniformity in their internal structures, as well as of an evenness of base, compared with chalk-hills, which generally rest on impervious strata of clay; and likewise owing to the openness of the texture of sand, which suffers the contained waters to spread freely in every direction. In Norfolk, where the general surface approaches to flatness, with shallow vallies, or dips, branching in among the rising grounds, the bases of the vallies are frequently (or were some years since) of the nature of morass,—were filled with deep moor,—the produce of bog-plants,—with water or fluid mire lodged beneath it; occasioned by the sand-banks on either side of it. And not only the bases, but the banks themselves, are frequently bloated with bogs, which have been formed by internal waters, where they are checked by masses of argilaceous marl, dispersed among the sands. And in every district and situation, where the substructure is of sand, or of a sandy nature, with masses or veins of clay or strong loam interspersed, the effect will ever be found similar."

He states, that "gravel comes next under consideration; and that it will serve to explain, further, the effects of rain-waters collected beneath the surface. It conducts water still more freely than sand. It is mostly found in thin strata or veins; sometimes in detached masses; but rarely in extended hills. In some situations it is nearly clean, or free from admixture of earthy matter. In this state it conducts water as a pipe; or, if embanked on every side, contains it as a cistern. When a stratum of subterrene gravel (or other free conductor) is supplied with descending waters, it either conducts them to the surface,—leads them to a fountain; or, if the surface is too strongly guarded to permit their escape, stores them up in quantity beneath the soil. The effect of water, thus pent up, varies with the form of the containing vessel, and with the quality and thickness of the covering, as well as with the inclination of its surface.

"If the gravel is partially deposited in veins, and the covering is thin, and of an absorbent quality, the water, wherever it approaches the surface, fills every pore of the soil, and though unable to break its way out in a stream, occasionally percolates through it:—thus encouraging the growth of superaquatic plants; which, being too gross and unpalatable for pasturing stock, fall where they grew; and, during a succession of ages, raise detached mounds of vegetable mold; partaking, like the moory basis of sandhill-vallies, of the nature of morass.

"If the containing stratum is more generally and evenly spread beneath the soil, and if this is of an absorbent quality, and moreover so thin as to be easily permeable, and lying nearly level,—a large extent of ground may, he says, be rendered worthless,—may become a mere morass, or extended bog. But if, under those circumstances, the land lies with much descent, the lower side only will be much affected. Again, if the soil or covering, though of an absorbent nature, is of a sufficient thickness and texture (conjointly) to prevent the contained waters from rising to the surface, a uniform breadth of cold weak land will take place. If the covering is not only thick, but non-absorbent, so as to prevent the depressed waters from rising to the roots or feeding fibres of agricultural plants, lands of a valuable quality are found: even in the state of perennial herbage, the finer grasses are produced. But, owing to the coolness which subjacent waters communicate to

the soil, in early spring, vegetation is later, and the produce less, than they would be, if the cause of coolness were removed. This description of land is, he adds, found in great abundance on the slopes, and at the feet, of rising grounds, in almost every vale-district of the kingdom." And "pebbles (a common substratum of land, in the more mountainous parts of the island) act, he says, in a similar manner: being a still more free conductor, than gravel is, of subterraneous waters." And, further, "rocks, if examined as conductors of subterrene water, will, he thinks, be found to have various effects, according to their natural properties. Sand-rock acts, like chalk and loose sand, as a filter. It is found, in quantity, in different parts of the kingdom. Slate-rock, being of an argilaceous or clayey nature, is, in a consolidated state, impermeable by water. But it generally abounds with fissures and finer crevices, especially near the surface, where water readily finds its way into it, and either filtrates slowly through it, or finds vent in a clift or separation of the masses; and, there collecting, forces its way to the surface, as a spring; or continues to descend, until it meet with a more compact stratum which dips towards the face of a hill or shelving ground; where, reaching the surface or outer limits of the rock, it either forces its way through the soil, and feeds a fountain; or, if the quantity of water is too small, or the thickness and texture of the soil is too powerful to permit it to escape in a body, spreads itself beneath the soil, or thicker covering, and produces watery land. A shelf of slate-rock operates, under these circumstances, as a stratum of sand or gravel. By examining the breast of a slatestone-quarry, after a heavy fall of rain, the filtration may be interestingly detected. Rocks of this nature are, he observes, common to Devonshire, to Wales, to Cumberland, Westmoreland, and the western Highlands of Scotland; being, he believes, peculiar to the more western parts of the island. Limestone-rocks, which are most various, in texture and arrangement of parts. The soft and granulous kind, of which the Cotswold-hills may be said to be composed, as well as the hills in the environs of Bath, and which is found in Yorkshire, in Northamptonshire, and probably in other parts of the kingdom, is of a porous absorbent texture; water acting upon it, as upon chalk. But the more ordinary species of limestone, which may be said to be found in every department of the kingdom, is of a closer texture. It is generally, however, divided into blocks, or broken into fragments; though sometimes found in continuous masses. But more frequently, the blocks appear as if they had been thrown fortuitously into their present situations; being separated by irregular interspaces, either filled with earth or other fossil substances, or forming open fissures and chasms of different widths; and, in a few instances that are *known*, form caves of extraordinary dimensions. This class of limestone-rocks may, he thinks, without risk, be considered as the most free and extensive conductors of internal waters in this country. While another species of calcareous rock, found also in different districts, is the most effectual non-conductor with which nature has furnished it. This peculiar kind of limestone is mostly found, in thin horizontal strata, situated a few feet beneath the surface of flat vale lands: as in the vales of Gloucester and Belvoir; or of level stages of higher ground; as in the central part of Somersetshire and other districts. In every instance that he has examined, the land which lies above it is rendered singularly cool, and in course unproductive, comparatively with the quality of the soil. The rock is not only, in itself, of a remarkably close even texture, and singularly free from fractures, but is commonly bedded in clay, which, as a substratum, continually acts as a non-conductor."

The writer concludes by remarking, that "other varieties of substrata might be enumerated. But those which are here brought forward, he conceives, will be sufficient to give a general idea of the action of rain-water falling on the lands of this country," so as to render the nature of draining them more evident.

Draining of Boggy Lands.—The draining of bogs, and other wet ground caused by springs, is in every point of view the most important, Mr. Johnstone observes, because many extensive tracts of ground of this description are at present lost to every useful purpose to which they might be converted, from the mistaken notion of those to whom they belong, that their nature is such as to render them incapable of being drained. But however impracticable the drainage of such bogs may appear, by attention to the principles here laid down they are not only easily drained, and at little expense, but, when they are made dry, are by far the most valuable of any. The nature of the cause, and formation of these bogs, have been already pointed out. They may be divided into two classes, according to their situations and the different methods of draining them. Those of the first class are easily distinguished by the springs rising out of the adjoining higher ground, in a regular line along the upper side of the wet surface, which, together with the proper line of the drain, are represented at *fig.* 1. in *pl.* XXIII.

The second class or kind of spring bogs, which are so denominated in contradistinction to those grounds that are wet and boggy by retaining surface-water, and also to such peat-bogs and mosses that do not originate from springs, have the appearance of being still more difficult to reclaim, although in several respects they are less so than the former. In these, the many springs that appear are not confined to one regular course along the upper side, but burst out promiscuously over the whole surface, especially towards the lower side, forming quagmires that shake all around, and bend under foot like a suspended cloth, over which it is dangerous for the lightest cattle to pass, and which show themselves at a distance by the verdure of the grass which the quags or spots immediately round the springs produce. Of this luxuriant grass, sheep are remarkable fond; and, devouring it greedily, never fail being attacked with that incurable disease the rot.

This is mentioned as a sufficient motive to recommend their drainage in sheep-walks. Under the peat-earth, that for ten or more feet forms the upper part of these bogs, is found a bed of clay, seldom of great depth, and under that a stratum of sand, gravel, or rock, if the adjacent eminences are composed of such. The clay-bed immediately above, and between this and the peat, being in many places very thin, and in some degree porous, the constant pressure of water contained in the high grounds above, forces that under the bog, with which it is connected, through the more porous parts of the clay and peat, where it bursts up, forming those appearances just mentioned; which, together with the situation and course of the drain, are more clearly elucidated at *fig*. 2, in the same plate. Such are the general appearances that distinguish these two classes of bogs; but there is, he says, a variety of wet ground injured by springs, which neither being so extensive, nor so much inclined to peat, to these the term *bog* cannot so properly be applied: but with regard to the mode of draining them, the same directions are equally applicable. As there are a variety of circumstances that lead to a discovery of the proper line of the springs, and that must guide the direction of the trenches in draining these bogs, as well as every other description of wet ground proceeding from the same cause, it will be proper to arrange them in the order in which they follow, previous to the execution of the work. The first thing to be observed is carefully to examine the adjoining high grounds, in order to discover what strata they are composed of, and also to ascertain as nearly as possible the inclination of these strata, and their connection with the ground to be drained; and to judge at what place the level of the same spring comes nearest to that where the water can be discharged. By this means, the length of cutting, and in some measure the quantity of water that the drain will issue, if it be wanted for any particular purpose, may be nearly ascertained; for, the greater the extent of the high ground contiguous to the bog, the more constant and more abundant will the discharge be; and if only a small hill or narrow bank, little water can be expected to run in dry seasons, when the porous strata can receive no supply from the rains. The surest way of ascertaining the inclination and *lye* of the different strata is by examining the bed of the nearest rivers, and the sides of the banks cut through by them, and any pits, wells, or quarries, that may have been dug in the neighbourhood. Rushes and other coarse aquatics appearing on the surface may facilitate the investigation; but these being often produced by stagnant rain-water, where there is no spring, cannot be trusted to in cases where more minute precision is necessary: small alder bushes, being of the same nature as rushes, and which grow naturally on very wet soils, are sure symptoms of the line of the springs, as they either grow up immediately over the spring or below it, seldom higher, unless where the water *backs up to*, when the spring is full. If the resisting stratum immediately under the porous one lie horizontally through the hill or bank, the surface below that level will be wet and rushy on both sides, and the upper side of the wet ground will be found varying very little from a level all the way round. When this is the case, which frequently happens, a drain properly conducted on the one side of the hill will carry off the water that causes the wetness on both, which is represented at *fig*. 3. in the same plate. If the resisting stratum dip or incline more to one side than to the other, the springs will issue only at the lower side of that stratum; consequently, the one side of the hill will be wet, and the other dry.

It is of material consequence, he says, to ascertain which of the different outlets that may appear on the surface is the main spring, or that from which these outlets are supplied; for, by cutting off that, the others become dry. It is, therefore, one of the principal circumstances upon which the true direction of the drain depends, if on the bank or sloping surface from whence the springs proceed they are found to break out at different levels according to the wetness of the season; and if those lowest down continue running while those above are dry, it is a sure sign that all the different outlets are connected with, and proceed from, the same spring; and along the level of this under one, the line of the drain should be directed, which if properly executed, all those above will afterwards continue dry. This is called the *main spring*, and those above the overflowings of it. If the drain was cut along the line of the uppermost of these outlets, and the depth of it not reaching the level of those below, the overflowings would only be carried off, the main spring still continuing to flow, and injure the ground below the bottom of the drain, having a natural vent lower. Such has, he says, been the common practice hitherto of draining ground in such situations, where the method here detailed is not understood, and which was reckoned the most effectual and most improved mode. Where-ever the uppermost springs made their appearance, there a trench was cut between the *wet* and the *dry*, as it is termed; which not being sufficiently deep to intercept the water, others of the same kind were cut one below another the whole way down the declivity; and being filled with loose stones nearly to the top, each carried off a portion of surface water only, without ever affecting the spring that caused the mischief. The consequence of such drains is, that they render the surface drier while they continue to run; but soon choking up, and bursting out in different parts, the ground presently becomes equally wet, or more so than before they were made. It is more difficult to drain this ground a second time even in the proper manner, as the surface, by means of the former drains, being so much altered from its natural appearance, the true situation of the springs cannot so easily be hit on, and the frequent bursts of old drains increase the perplexity. It frequently happens that the uppermost (if the *strongest outlets*) are the main springs, and those below only *leakages*; which implies, that some of the water from the main spring finds a passage through some opening in the *upper soil* near the surface, and breaks out lower than the main spring,

when it meets with resistance from any bed of clay: by cutting off the main spring, this of course becomes dry.

Therefore the same caution is necessary to ascertain this before proceeding to mark out the drain, as from the *main spring only* the level must be taken, in the manner which will be described hereafter. In irregular banks, where the ground, owing to the perpendicular situation or pressure of water behind, has slipt or fallen down, the drain must be carried higher up the declivity than where the water has its apparent outlet to the sound ground that has undergone no change, and where the *real spring* will be intercepted; the water in the slipt sand below being only leakages from that above, but which is apt to deceive in cutting the upright trench, or that which is made from the outlet up to the cross one, along the line of the springs. When the main spring rises in a steep bank, a considerable height above the level of the brook or place where the drain is to discharge itself, it is unnecessary to cut a deep trench, or to lay a covered drain, all the way from the brook up to it; for, the descent being too rapid, and if deep cut, by crossing veins of sand, that are always met with in such situations, the bricks or stones with which the slough or conduit of the drain is laid would be undermined by the rapidity of the current, which would also carry down a great quantity of the loose sand; but it should be begun only so far down the bank, as, by cutting in level, the drain may be six or seven feet lower than the outlet of the spring, or whatever depth is necessary for drawing down the water to such a level, as it may discharge itself without rising to the surface, or injuring the ground adjoining to it. The remaining part of the cut, down to the brook, either in a straight or sloping direction, may be left open, and need not be deep, but guarded from the cattle, and from the plough when the field is in tillage. If covered, it need not be deeper than two feet; and there is no occasion for boring in any part of it. This may be more perfectly understood by referring to *figs*. 4 and 5, in the same plate.

If there be any difficulty in ascertaining the exact line of the spring and that of the cross drain, where it does not appear on the surface, or when there is no apparent outlet from whence to take the level, in bringing up the leading drain for carrying off the water, it can be then, he says, discovered when it crosses the proper line, and, without cutting any farther up, the cross drain must be carried on that level, so far to each side along the tail or termination of the rock or sand containing the water, as the situation of the ground and other circumstances may require. And if in cutting the cross drain, the line marked out by the spirit level should be found in some places to be below that of the springs; and if in boring along that line no water is found, then small cuts must be made of the same depth, from the drain up to where the spring lies, as shown at the letters *A A A*. in *fig*. 4; for, if the drain is cut below the line of the spring, all possibility of reaching it, even by the auger, is lost, as boring can have no effect where the substratum is clay, and where there is no under water; and if it is cut above the line of the spring, it will require deeper cutting and boring to reach it, as there, for the most part, the ground rises higher, and that part of the porous strata below the drain may contain as much water as may injure the ground, and which may easily pass under the bottom of the trench between the auger holes, and find vent below it. If, says he, the expanse of the valley or bog betwixt two banks be so narrow that the stratum of rock or sand containing the springs unites within reach of the auger below the clay, one trench up the middle, with auger holes, will do the business, without any cross or branch drains, as is shown in *pl*. XXIV. *fig*. 1, Although the springs that injure ground in this situation break out of the banks, he says, all round nearly on the same level, yet the reservoir from whence they proceed may be hit on in the middle of the valley, by boring through the superincumbent body of clay that forces the water to rise and ooze out along the upper edge of it, at its junction with the higher porous ground. The drain being cut in the hollow part of the ground, and the spring below bored into, it is evident, that the depth of the drain being so much lower than the natural outlet of the springs, the pressure of water above that level (bottom of drain) will force that under the trench through the auger holes, or even for some time, until the water subside, it might be made to rise higher than the level of its natural outlet. The consequence of this will be, he adds, that the water of the spring having found, by means of the drain and boring, a new and easier channel, will soon abandon its former outlets, and cease to overflow the ground that formerly lay below it

In very wet swamps or bogs of great extent, it is necessary, he says, to have other cuts than those that carry off the springs; for, although the upper springs, which are the principal cause, be cut off, there may be veins of sand or gravel lower than these, out of which it is also necessary to extract the water. If the ground is to be divided into enclosures, the open ditches may be so directed as to hit on these lower callections of subjacent water, as well as to carry off any that might stagnate in the hollow parts of the surface.

Many extensive tracts of land are, he observes, wet and rushy from a cause that cannot be removed by any number of open or covered drains. This is called haugh or holm-land, and lies along the sides of brooks and rivers, which having altered their course so often between the opposite banks, and depositing sand and gravel as they recede from their last channel, the water percolates through the ground thus formed to the level of its present course, keeping it so moist and wet as to produce rushes and other aquatics; and wherever a drain or pit is dug in such ground, it immediately fills with water to the level of that in the river.

Where the river has a quick descent, it is less apt to produce this effect; but where the current is slow, and the level of its surface little below that of the ground on either side, the soil will be more satu-

rated with water. Any number of drains cut in any direction, can have no good effect while the river continues in its present course at such a height.

The only remedy therefore, where it can be done at a moderate expense, is, he thinks, deepening and widening the bed of the river, the earth taken out of which will, at the same time, form an embankment on either side; for while it can rise higher than the outlet of the drains, and flow back into them, it renders the ground equally wet as before they were made, and the expense of making them is laid out to no advantage. Besides being injured by the river water, springs, in many situations, issue from the bottom of the higher bank, and ooze through the soil higher than its level. The water of these can easily be cut off or lowered to the level of the river by a drain.

In some cases, the wetness proceeds, he says, entirely from springs, where the soil of the flat ground betwixt them and the river does not consist of loose gravel or sand, but of a loam or clay mixture. In this case the water of the springs is resisted; and prevented from percolating through the soil in its way to the river, and is forced to rise to the surface over which it flows. To drain this ground, a trench must be begun at the lower end of it, and brought from the river along the bottom of the bank from whence the springs issue. This trench should be cut below the line of the springs, where it can more easily be done, and kept open to receive the river in floods, which would *blow it up* if covered; and also any runs of water from the high ground in time of rains.

From this trench, short covered drains must be cut up a little way into the bank, as represented at *fig.* 4, in *plate* XXIII. The bottom of these must be higher than the level of that of the open cut, to prevent any of the water in it flowing back into them. In these the auger must be used to tap the springs, if the depth of this level does not reach the stratum containing the water.

There will, he says, be no occasion for any cross drains betwixt the open cut and the river, as all the water that is intercepted will be carried along the bottom of the bank and emptied into the river at a lower level, unless the ground is of such extent that it may be divided by cross ditches into separate enclosures. The open drain along the upper side will serve as a division betwixt the meadow and higher ground. The next thing to be considered is, he observes, the conducting of the drain after the levels have been taken, and the true line of it fixed, and whether it should be covered or open. If the land is to be enclosed, and as the line of the trench may serve as a proper division of the ground, it may be made an open cut, if not a covered drain; but it is first necessary to ascertain which, as the depth, width, and other circumstances, may be regulated accordingly. After finding the nearest outlet where the water collected in the drain can be discharged, from that a trench must be brought up to the cross one that is to be carried along the line of the spring, allowing a small declivity of a few inches in every ten yards for the water to run. In cutting the drain that is to carry off the spring, if after passing the clay, there is a stratum of hard gravel betwixt that and the sand containing the water, it is preferable to lay the sough there, being a more solid foundation for it, and either to perforate the gravel with the punch, or open small pits through it with the spade; by means of which the water will flow up, and run as speedily off and with more safety than if the sough had been laid in the sand itself; which would not only increase the depth and difficulty of working it, but in many cases the level of the orifice will not admit of the drains being cut to this depth. Also if, in cutting the trench along the tail of the rock, the level of the orifice will not admit of its being cut so deep as to touch the rock, the clay or impervious stratum that lies immediately above it must be bored through, when the water will flow up through the fissures of the stone, and through the auger-holes, into the sough; but it is preferable, in cases where the level will admit, to dig the drain through the clay, and so far into the rock, as will furnish stones for laying the sough; and then the water will meet with less resistance, and have a freer issue, than if the stone had not been opened or broken. This will, he says, increase the expense of cutting the drain, but lessen that of quarrying the stones elsewhere, and of carrying them to the place where the drain is made. Although, in the ground to be drained, there may be a ditch or other old water-course in which it may be practicable, by means of boring, to tap the spring, yet it is better to make a new trench, in which the water of the spring only can have admittance; and where this must cross any ditch or old water-course, it must be secured by puddling with clay, so as not to receive any surface water, which, by being augmented in time of floods, might blow up and destroy the sough. As the water thus obtained by means of boring may be converted to several useful purposes, as those of irrigation, serving small mills, canals, houses, fish-ponds, pastures, fields, &c. caution is necessary in using the auger, lest the water procured in one part of the drain may be lost at another in the same manner in which it was found, and, in the endeavouring to procure a greater supply, it may by that means be let down from a wet into a dry porous substratum, as will be shown hereafter.

Such are, he says, the chief objects that require consideration before beginning to cut the drains; the following directions will be useful in guiding the execution of them. If the drain is to be cut through a soft boggy soil, it is better to be open than covered, especially where it may receive other water than that collected from below, and can at the same time serve as the side of an enclosure or division betwixt the upland and low grounds; stones laid in such drains are soon apt to sink, owing to the softness of the bottom, and the sough may also be soon choked up. The width of a covered drain may be from three to four feet at top, and one and a half or two feet wide at bottom, thus allowing six or nine inches for each side-stone, and six inches between for the passage of the water, forming a square conduit, or what is termed the sough, being also six or nine inches in

height. The depth is regulated by the level of the place where the drain is to empty itself, and the nature of the ground through which it is cut. The turf should be first pared off thin, and laid to one side for after use, and all the mould thrown out to the other. The most difficult part of the work is laying the sough in running sand, where it is necessary to have the sides of the trench supported with flat boards and props, which are removed forwards as they proceed in working, and which keep the sides from falling in, and the loose sand from falling amongst the stones with which the conduit is laid. If the sough or conduit is laid with brick, a small aperture must be left betwixt each to admit the water from the sides of the drain, and the thin turfs must be laid above, grass-side downwards, to prevent the mould from getting through the openings. The turfs are laid grass-side downwards, immediately above the stones, without any loose stones above the laid ones, as the water is all collected from the bottom of the drain, very little from the sides of it, and none admitted from the top. In quick or running sand, turfs must also be laid in the bottom of the drain, under the sough, to prevent the loose sand from flowing up, and to render the foundation of brick or stone more secure in case of their sinking. In these sands, it is also better to dig a little into the sides of the trench, off the line of the sough, where the auger is to be used, and after boring to cover the places in the same manner as the rest of the sough, as the sand thrown up by the spring can then be more easily taken out with the hand till it subsides and gives over running, and is likewise off the main current coming down the middle of the drain. This is done somewhat as at *fig.* 7, in *plate* XXIV.

That part of the sough above the auger-holes should be left uncovered till the sand is all thrown up, and the openings clear; but till then, the sand must be taken out, and the sough may afterwards be covered up with safety. Above some of the auger-holes, or at any other convenient part of the drain, a kind of funnel may be built to the top of the trench, whereby it can at any time be looked at to see if the issue is clear, and if the quantity of water diminishes or increases. When the circumference of the auger-holes is not sufficient to let up the quantity of water which the springs would otherwise issue, where it is not far from the bottom of the trench to the stratum containing the water, and where there is a bed of hard gravel intervening, impenetrable by the auger, holes must be dug with the spade down to the spring, and these holes filled up with loose stones; first putting down a round stake in the middle, which, after the stones are filled in, must be drawn out, which leaves an opening for the water to flow up. No apprehension need be entertained of the holes made by the auger being filled up, whether the drain be open or covered, provided no other water is admitted; for such is often the force of the spring, that it will throw up any earth or other sludge that may accidentally get into it, and it can be injured only by the admission of great quantities of surface or flood water coming upon it at once. When flat stones can be got, they are preferable to brick; but there are several kinds of brick besides the common sort, invented and used solely for the purpose of draining, in several parts of the kingdom, where the expense of stone would become greater. When small drains are wanted, and when the water is to be conveyed to a house, &c. that represented at *fig.* 1, in *plate* on Draining-bricks, is commonly made use of. For larger drains, those at *fig.* 2 and 3. are well adapted, especially the latter. They are laid single, without one reversed under; for, when that is done, the water running on the under one occasions a kind of sludge, which in time becomes so encrusted on it, as totally to obstruct the passage of the water, and render the work useless in a few years. In clay bottoms they may be laid single, or without any thing under; but in soft sandy bottoms, a common building brick should be laid under each side to prevent them from sinking down, and be so laid as to form a regular arch, the better to support the pressure above from breaking them. They may be constructed in the above shape, to any dimension suitable to the quantity of water the drain is to convey.

Although the earth that is thrown out of the drain should, when filled in again, be considerably higher than the surface of the ground on each side, it must remain so; for in a year or two it will subside to the level of the surface on each side. What remains may be spread or laid in some adjoining hollow; for, if levelled at first, the earth sinks down, and the rain by that means lodging in the hollow and subsiding downwards may injure the sough. While the drain is cutting in very wet peat soils, the surface water, or what may ooze from the sides before coming to the spring, must be stopped here and there; and when let out to run through the sough; a turf must be laid so as to prevent any sludge which it may bring down from running through along with it. When trees, especially ash, happen to be in the course of the drain, they must be entirely grubbed up, otherwise the roots will get into the sough, and, expanding through the joints of the stones, will soon put a stop to the passage of the water. When the water issued by the drain becomes of a red ochrey colour, it indicates a stagnation either from the above cause, if amongst planting, or from some part of the sough having fallen in; which should be speedily repaired, otherwise the ground will soon become equally wet as before. Lastly, he says, the mouth of the drain should be carefully railed in, or otherwise guarded, to prevent the cattle from trampling it or choking it up, being fond of drinking there for the sake of the cool water, even although there be watering-places in the field; and when there is any defect of this kind, it should immediately be remedied. The first symptoms of the drains having effect, and which soon appear when the spring is properly tapped, are, that all the surface drains that may have formerly been made, and also any adjacent pits, ditches, or places to which it may have backed up, immediately become dry, and remain so afterwards. On the whole, it appears, from the foregoing observations, that this mode of draining bogs, or land in-

jured by subterraneous water, is by far the most effectual of any that has yet been suggested; and thta such ground may be made completely dry, by cutting off one spring alone with which the particular place to be drained may have no apparent communication, but which may be so connected under ground, that from it all the others derive their source; and being therefore the principal cause of the whole, to hit on it seems the chief desideratum of the business. Many instances of this have occurred in the practice of draining boggy land. At Odstone Hall in Leicestershire, a considerable tract of wet marshy ground of very little value, divided in the middle by a small river, was, it is observed, so completely drained by Mr. Elkington, by making a small trench at one side, and by boring in it, that the part of the marsh on the opposite side of the rivulet, which was at a very considerable distance from the drain, became in a short time equally dry with that where the cut was made, has continued so ever since, and from being formerly of little or no value is now converted into excellent watered meadow, producing, without manure, abundant crops of grass.

At Madely, near Newcastle in Staffordshire, there was likewise a very considerable bog of some hundred acres, the drainage of which was deemed impracticable, being of so wet and soft a nature that no cattle could pass over any part of it, till this experienced drainer lately obtained a lease of it for a certain number of years, and, by means of a very little cutting and expense, has in consequence effectually drained it.

Draining of Hilly Lands.—In hilly districts, where sheep are the staple or chief produce, less attention seems to have been paid, Mr. Johnstone says, to the drainage of such parts of their walks as are wet and unproductive, than to that of arable ground, although the effects in the one case are equally beneficial with those in the other. This neglect is often attended with considerable loss. From the nature of the herbage which a superabundance of moisture produces, whether stagnant on the surface or long confined under it, proceeds that almost incurable malady the rot, to which so many thousands of valuable animals fall a sacrifice. For this, draining is a most infallible preventative; and in such situations it is attended, he says, with little expense, as the drains may, for the most part, be left open, with here and there covered passages, over which the sheep may cross with safety.

And although in places where the depth of the cut does not reach the spring, the auger must be applied, no apprehension need, he thinks, be entertained of the holes filling up where the drain is left open; for the force of the spring will of itself throw up any sand or sludge that may get into them, provided no great quantity of flood or surface water is admitted. But the better to secure them against any obstruction, small openings may be made along the upper side of the trench: and in these the perforations may be made, leaving the mouth of the auger-holes about six inches higher than the bottom of the drain, which will be without the reach of the water that may accumulate in time of rains, as shown at *fig.* 8. *pl.* XXIV. From the irregular disposition of the component strata, the sides of many hills are covered with alternate patches of wet and dry soil. By the appearance of the surface, and by the vegetables it produces along the declivity, the internal strata, and manner in which they lie, may often be ascertained with such a degree of precision, as to guide the direction of a drain without investigating below the surface; for the difficulty or facility with which such ground may be drained depends entirely upon the *lye* of the different strata of which the hill is composed, and upon the perpendicular or horizontal inclination of the rock or body in which the water is contained. If the rock lies in a horizontal direction, all the different outlets or springs that appear on the surface may proceed from, or be connected with, the same body of water, and may all be dried up, by cutting off or letting out the main body of water that supplies them, at the lower part of the reservoir, or place where the water would of itself run off more easily, if it was not confined under an imperviable covering of clay. But, where the rock lies in a perpendicular manner, and contains only partial collections of water amongst the more open fissures of the stone, which empty themselves at numberless outlets unconnected with one another, it would be preposterous to attempt cutting them off by one drain, or by *tapping* any particular one of them, without a drain being cut into each, as shown at *fig.* 3, *pl.* XXIV. In this manner it is better to cut the main drain all in the clay, with small cuts up to each outlet, than along the dotted line or place where the springs break out, as it would in that direction be too much in the rock, and difficult to cut, from the nature and inclination of the stone. Where the water issuing out along the dotted line can, by means of the auger, be hit on in the main drain, at the point *A*, *A*, *A*, it will be more effectually cut off; but if that is not practicable, the depth of the small cuts will reduce it to such a level as to prevent its overflowing or injuring the surface below. In many hills composed of alternate strata of rock, sand, and clay, the surface of the latter is commonly wet and swampy, while that of the former is dry and productive, and therefore requires as many cuts to drain it completely as there are divisions of wet and dry soil. The highest part of the hill, being for the most part composed of porous soil, receives the rain-water which descends through it, till it meet some impervious stratum, as clay, which obstructing its percolation any farther downwards, it then rises to the surface, and forces itself a passage over that impassable stratum. After it has thus overflowed the upper clay surface, it is immediately absorbed by the next porous stratum, and, descending into it in like manner as above, it again issues at the lower side of it, and injures the surface of the next clay-bed, as it did that of the first. In this manner the same spring will affect the other similar strata of which the hill is composed, down the whole declivity, and form at last in the hollow a lake or bog,

if there is not a proper outlet or descent to carry off the water. In order to drain a hill-side of this description, it is necessary, he says, to begin by making a trench along the upper side of the *uppermost* rushy soil, which will have the effect of cutting off the highest spring: but as the rain falling on the next porous soil subsides to the lowest part of it, and forms another spring, a second cut is necessary there, to prevent that water from injuring the surface of the next clay-bed. Thus similar cuts will be requisite lower down the descent, so far as the same springs and appearances continue to injure the ground, which may produce a quantity of water sufficient to irrigate the lower ground, or which may be useful in some other respects, as may be seen by *fig.* 2, *pl.* XXIV.

In some hills, the strata of which they are formed lie so regular, that it is practicable to extract the water from either side on the same level, which would be a very considerable advantage in draining the one side, and irrigating the other, for there is often found on the one side a wet swamp, and on the other the soil too dry. This is owing to the bed of clay that upholds the water not lying horizontally, but *dipping* more to the one side than to the other, and by the one (the dry) side being *overlapt* by a covering of clay, whereby the water is forced to issue at the open side; but if an outlet is given to it on the dry side, by means of a drain lower than that from which it flows on the wet side, the course of the spring may easily be diverted. The opposite side being porous, and covered with sand, will act as a reservoir, to receive the rain-waters, which will afterwards flow through the opening made in the clay. This may be of great use in supplying a house with water that is situated on the dry side of the hill, and save additional expense of conveying it in another manner. Care must, however, be taken in conducting the drain for conveying water to supply a house, &c. not to cut it or bore in it so deep as to reach a porous stratum, otherwise the water that may have been found at one place may, by the same means, be lost at another. This is shown by *fig.* 4.

A spring in a low situation, adjacent to higher ground, may be raised to supply a house, or for any other useful purpose, although much below that level, by confining it in a pipe, or brick chimney. The reservoir from whence the spring or outlet of water is supplied being confined, and pent up between two impervious strata, and the upper part of it extending perhaps to a considerable height and distance in the high ground, it is evident that, if a perforation be made through the superincumbent stratum into the *tail* or lowest part of the porous stratum containing the spring, the water may be raised by confining it nearly as high as the level of the head of the reservoir, which is shown by *fig.* 5.

Of this kind there have, he says, been several instances in actual practice, where the water procured from draining low-grounds has been raised to a considerable height above the level of the drain. The drain, in such cases, should be closely built with brick, and puddled above with clay, to prevent the water from oozing through the joints. It is thus made to rise, through some sort of confined passage, to the height which is required, by the pressure which it receives in the high ground. The advantages of such operations, it is remarked, must be very great in many situations, and may often be accomplished with success, where many would think them impracticable. Of the practicability of this, however, and that water may often be raised to a very considerable height, by means of its pressure in distant ground, the following remarkable occurrence, which happened lately in digging a well in the vicinity of London, is a proof. Earl Spencer, for the preservation of his noble mansion-house at Wimbledon against fire, and to be well supplied with water, ordered a well to be dug at a little distance from the house, which was sunk to the amazing depth of near 600 feet, before any spring was found. It was begun on the 31st of May, 1795, and on the 12th of August, 1796, the man, who was employed in the undertaking, gave a signal to the person above to draw him up, as he had found the spring, and was immersed in water so deep, that his life became endangered. In the space of four hours, the water rose to the height of 350 feet, and during two days following its increase was more than a foot an hour. The water, proceeding from a rock, is remarkably fine, and from the strata it passes through is strongly impregnated with mineral qualities. As there is no extent of higher ground near that where the well is sunk, and as the depth of it is some hundred feet below the bottom of the Thames, the source of the reservoir, from whence the spring is supplied, must be situated at a very great distance, and must contain a very large body of water to raise it so suddenly to such a height.

Draining of boggy and other wet Ground, by perforating through a retentive to a porous Substratum:—

Another method is to be pursued in draining bogs and other kinds of wet ground, where the bogs or wetness is not produced by springs, which is by perforating through the retentive to the porous substratum. In many parts of the kingdom, it is remarked, in the account of Mr. Elkington's modes of draining, that considerable tracts of land lie waste and uncultivated, owing to wetness in a particular situation, that might by this means be easily drained, and rendered much more productive. The cause of their wetness, it is observed, proceeds not from springs lying under the surface, nor from the overflowings of any in the adjoining higher grounds, but from the accumulation of rain-water stagnating on a retentive body of clay or other impervious substance, through which the water can have no descent; and being also surrounded with higher ground of the same impervious nature, the water of itself can have no natural outlet. Such ground, when it becomes boggy, is commonly called land-locked bogs. The situation of these bogs being often so much lower than the ground that surrounds them, the cutting of a main-drain, or conductor, for carrying off the water collected by the smaller drains

would, in many cases, be attended with an expense greater than the value of such land when drained. The thickness of the impervious stratum that retains and upholds the water is often so great, that although the strata under it be of a porous and open nature, as rock-sand, or gravel, the water can find no passage whereby of itself to descend through the one into the other; and therefore, by its long stagnation above, all the coarse vegetables that have for a series of years been produced on its surface, and even the upper part of the soil itself, are formed into a body of peat-earth, equally soft and less productive than that of any spring-bog, and which is only passable by cattle in very dry seasons, when the wind and sun exhale part of its moisture; and is even then inaccessible to the plough. The drainage of these bogs must be effected in a manner different from that of spring-bogs, the cause of both not being the same. It may probably be done in the following manner at least expense. The first drain must be made in the middle or lowest part of the ground, and into this all the others must lead. The number and direction of these must depend on its extent. They must be cut through the peat, or wet, spongy, upper soil, to the top of the clay or retentive substratum, which must be perforated by the auger, in order to give an outlet downwards for the water, which will be absorbed by the porous strata below. The making one large pit or well in the middle or lower part of the bog, dug through into the porous substrata, with the drains leading into it, would answer equally well, and would save boring along each of the drains; this is a method which has frequently been practised with success in different districts. Where the first method is had recourse to, the drains should be cut as narrow as possible, and, after the auger-holes have been made, should be filled with loose stones to within a foot and a half of the surface; and this vacuity may be filled up with part of the earth taken out having a turf, grass-side downwards, next the stones. The water and noxious moisture contained in the peat or upper-soil will be extracted by the drains, and will subside through the auger-holes. If the ground is afterwards ploughed, care must be taken in forming the ridges, and giving them a proper descent towards the main-drain, which will greatly assist the others in discharging any heavy falls of rain-water.

Before proceeding to drain this kind of land in the manner described, the following observation must be attended to: It should be discovered, in the first place, whether the porous strata immediately under the clay be dry, and will receive the water when let down into it from above, or, being saturated with water itself, may, in place of receiving more, throw up a greater quantity to the surface; and thus, instead of remedying the evil, render it worse. This may sometimes be the case; and the substrata may contain water that makes no appearance on the surface, at this place, owing to the superincumbent body of clay, but which, being connected with some higher spring, may flow up when a vent is given to it by the auger. Thus would a greater quantity of water be brought to the surface, which, having no outlet through the circumjacent bank, would render the ground much more wet, and might even in some situations almost form a lake. If the surrounding high ground declines deeper or lower than the bog, although at some distance, by means of a spirit-level and the appearance of the surface, the nature of the under-strata may in a certain measure be discovered; and although it should already contain water, a drain may be there cut to draw off that water, and also what is let down into it from above, as is shown at *K*, in the section of *fig.* 6.

It is remarked, that Dr. Nugent, in his Travels through Germany in 1766, has shown the mode of draining marshes in that country to be nearly on the same principles as those explained above. The draining of marshes, says he, is conducted in much the same manner as that of lakes, but he has there seen the operation performed only on what we call moor or turf-grounds. These are most easily drained by carrying trenches through those grounds, when the disposition of the country is such that the water can be conveyed to some neighbouring stream.

The first thing they do is, he says, to carry a ditch to the middle of the moor in a direct line, its depth and breadth adapted to the extent and wetness of the ground; and thus to the supposed quantity which is to be carried off. At every six, eight, or ten perches, as the ground is more or less swampy, cross-trenches on both sides are drawn in a direct line, and communicating on both sides with the main-trench. But, in case of water coming from any neighbouring eminences, they dig a trench round the whole ground as a reservoir; and this likewise communicates with the main-trench, &c. In case the draining of the water into some natural receptacle be not practicable, at least not under a very great expense, then they have recourse to sinking-ponds or reservoirs in some neighbouring bottom, and to these they carry all the trenches. These ponds are likewise, he observes, of use as a fishery; but if even the sinking of such a pond be too chargeable, there still remains an expedient which is of good effect, and chiefly if the moors are not too wet and marshy. It is the nature of moors, in general, that, beneath the turf or moss, there is a loam which hinders the moisture from penetrating, and this indeed is what makes the marsh, and causes the luxuriant growth of the turf or moss; but this loam or clay is only a stratum, and far from being of an immense depth; under it is generally a sand, or some other stony or loose soil. Here reason readily informs us, he says, that a middling morass may be drained by perforating the clay, and thus making way for the moisture to penetrate. In order to this, a pit is dug in the deepest part of the moor, till they come below the obstructing clay, and meet with such a spongy stratum as, in all appearance, will be sufficient to imbibe the moisture of the marsh above it. Into this pit the ebbing of the morass is conveyed through a trench, and both the trench and pit are filled up after the first drain with large broad

stones, setting them edgewise, so as to leave interstices for carrying off the water; then such stones are laid over breadthwise, and these covered with loose earth, like that on the surface. When no such stones are to be had, strong piles are rammed down the sides of the trench, and broad boards laid across, and these are covered with earth to a height fit for culture. This is a matter of no great expense, the pit being as near the morass as the water will admit, and the trenches but short; then they have a drain unperceived, which leaves the surface of the trenches for the plough; and in middling marshes, or especially in such moors as are only wet and damp, this method, though sometimes slow, never fails taking effect, and many tracts are thereby made serviceable to the farmer or grazier. Much land, in some parts of this country, has been drained in the manner here described.

In *pl.* XXV. *fig.* 1, is a plan given by Mr. Elkington for draining in low swampy lands on the sides of rivers, in which are shown the advantages that may in some cases be gained by irrigation, or throwing the water over it. *Fig.* 2 exhibits the manner of accomplishing the business, where the water is dammed up as a mill-lead; which is a trough many feet longer than the width of the dam on each side, as seen at *A.* and *B.* It is made secure by stakes driven into the earth on each side, with cross-bars above, as seen in the figure. The space between the top of it and bottom of head must be well rammed with clay, and a cut is requisite on the bank or head for securing the water.

Draining of Lands, where the Soil is composed of alternate Beds of Clay and Sand:—

In districts where the soil is composed of an intermixed variety, and where clay forms the most predominant part, draining is, Mr. Johnstone says, a work attended with much greater difficulty and expense than in those where both the surface and internal strata are more regularly disposed. In these kinds of soils, where every reservoir of water is unconnected with another, being separated by intervening beds of clay, the partial collections of water that these reservoirs contain are so much augmented in time of great rains, that being full to the level of the surface of the surrounding clay, the water having then a free issue as over the edges of a dish, so overflows and surcharges the surface of that clay, and renders it so wet and sour, that its produce becomes every year more scanty, and the nature of the soil itself more barren. As these sand-beds have no communication with each other, it requires as many drains as they are in number to extract the water from each of them. From the nearest and lowest part of the field to be drained, a trench must be cut up to the highest or most distant sand-bank, in such a direction as, if possible, to hit on some of the intermediate sand-beds, and save making a longer side-cut, otherwise necessary; but where this would necessarily lengthen it, and where by crossing the beds in places higher than the surface of the surrounding clay would considerably increase the depth of it, and be difficult to work, especially if rock or running-sand, drains in the form of the letter Y must branch off to such beds, to draw off the water they contain, and to convey it into the leading one, as represented at *fig.* 1, in *pl.* XXVI. Although the sand-beds throw out the water they contain on all sides, so as to injure the clay-surface immediately round them, a drain on the one side will completely extract the water from the whole, and prevent it from breaking out at either side, provided that where it is cut be the lowest. It may be observed, that unless the drain is so cut, it cannot be supposed to have this effect, while the water can find an outlet on the opposite side of the bank, lower than the bottom of the drain. This ought therefore to be previously considered: and by carefully examining the ground, and applying the spirit-level, the proper side for the drain may easily be found: or, if the water bursting out round the bank has been observed in dry seasons to run at one place and not at others, it is a proof that this is the lowest point; and by cutting the drain in the direction of this level, the water will afterwards be prevented from rising to the height of the upper outlets, or above the level of the bottom of the drain, even in the wettest seasons.

Besides soils corresponding to this description, there are others nearly of a similar nature; but each bed being of less extent, and lying more regularly together, their drainage can be more easily effected by means of less cutting, and consequently less expense. Under the beds of sand and clay that thus lie alternately together, and almost parallel to one another, is found a body of impervious clay that keeps up the water contained in the sand, which continues always full, moistening the adjacent clay, and in wet seasons running over it. As the main under-stratum of clay is seldom above four or five feet below the surface, a drain must be cut to that depth through the middle of the field, if it have a descent from both sides; or if the ground declines all to one side, the drain must be cut there, where the water will more easily discharge itself into it; and unless the field is of a considerable extent, and have more hollows in it than one, one drain will answer the purpose effectually; for, by crossing all the different beds that hold the water, it will draw it from each, as is represented at *fig.* 2.

The great difficulty, however, in draining land of this description, and which is impracticable by one drain, is if the direction of the alternate beds of clay and sand lie across the declivity of the grounds; so that one drain in this case can have no other effect than that of carrying off the water after it has passed over the different strata, and would here naturally stagnate in the lowest part of the field, if there was no other outlet for it: therefore, when the ground lies in this manner, which is often the case, besides the drain in the hollow, others must be cut up from it, in a sloping direction, across the declivity, which, by crossing all the different veins, or the very thin and narrow strata of sand, will extract the water from each, as is shown by *fig.* 3. Where these alternate strata are of great extent, and

the wetness produced by greater springs, forming swamps at different levels on the side of hills, the method of draining them has been already described.

The first thing to be observed, in the drainage of such alternate soils, is to discover minutely the inclination of the alternate strata, or how they lie with regard to the situation of the field to be drained, as upon this the direction of the drains entirely depends; and as the internal signs that distinguish the different beds are easily perceptible, from the appearance of the surface, and difference of the herbage that each produces, there is little difficulty in attaining this part of the object. In drains of this kind there is seldom any need for applying the auger, as the necessary depth of the trench reaches far enough down; and as there is no spring for want of connexion with the higher ground to force itself up through the auger-holes, or, if there is, it cannot, at so great a depth, and below such a body of clay, do any injury to the ground above.

The drain, after being formed like a *sough* at bottom, or set like a triangle, must be filled a considerable way up with small stones, before the mould is thrown in, taking care to have tough sods laid immediately above the former. Where stones are scarce, and plenty of brush-wood at hand, faggots may be substituted in their place with propriety. The under part of the drain, however, should be laid or *coupled* with stones, as a canal to carry off the water subsiding through the faggots; and which has also the good effect of prolonging their duration; for when the water cannot get off, which must be the case where there is no open conduit of stones, its stagnation amongst the branches must soon cause their decay, and choke up the passage of the drain. There is one thing more to be attended to in completely accomplishing the drainage of these soils: If the field lies very much on the descent, care must be taken in laying out the branch-drains in a direction sufficiently horizontal, so as not to make the fall too precipitant, by which the bottom of the trenches would be worn uneven, and this would obstruct the passage of the water, which might soon blow them up; but the fall should be such as to enable the water to clear its course. The reason why fewer drains are required in fields that lie nearly horizontal, as those of the second kind here mentioned, is, that the water is drawn equally from both sides, whereas those on a sloping declivity, drawing only from the higher sides of the drains, require them to be more in number, or closer to one another. This is the case in every situation where surface-draining is necessary, and particularly so in such soils as those that will be immediately described.

In Lancashire, where these soils, composed of alternate beds of clay and sand, very much predominate, and which have there acquired the names of *sand-pots*, or *guts*—a term properly enough applied to them, from their holding water like a pot, it is observed, that Mr. Elkington has executed several drainages in the manner here described, and also a very difficult one of the same kind at Sutton-Hall, Derbyshire, where the water was contained in small beds of rock, crossed and intercepted by beds of clay, as has been shown by *fig.* 1.

Draining of Land, where the Soil is porous above and retentive below, &c.

It is remarked, by the writer of the Account of Mr. Elkington's Mode of Draining, that, in flat tracts of land, where the surface or upper soil is injured by a superfluity of stagnant water, not proceeding from springs, their drainage is an object of the first importance, and which may, in most cases, be accomplished with very little expense. The upper soil being composed of a porous stratum of two, three, or four feet in thickness, and having under this a strong retentive body of clay, the rain-water falling on the surface easily subsides till it meets the clay; and there being obstructed from farther descent, the whole open part of the soil stands so full of water as to retard the progress of vegetation, or at least greatly to injure it. This kind of soil is commonly denominated *wet-bottomed land.* To carry off this water requires only, he says, one or few drains, according to the situation of the field, and these no deeper than just to reach a few inches into the clay, betwixt which and the under part of the porous soil the greatest quantity of water will remain stagnant, when it does not appear so much on the surface. In this kind of drainage there is no need for the auger, there being no real spring or subterraneous water to get rid of.

If it has a small descent from both sides, one drain cut through the porous to the clay soil, in the hollow part of the field, will effectually draw off all the water that the porous soil may contain; which will be greatly facilitated by properly forming the ridges to answer the declivity of the ground, and by deepening and clearing out the furrows with the spade, as is shown in *fig.* 4, *pl.* XXVI.

If the situation of the field correspond with the representation of it in the plan, the water will flow into the drain (being in the hollow part of it) through the porous strata, as well as through a number of small trenches cut up from it to both sides, which is the common practice in Essex and some other counties adjoining; and, from its being so much practised there, is commonly called the *Essex Mode of Hollow Draining*: but it is, he says, cutting up a whole field to no useful purpose. The drain may either be open, if it can serve as a division of the field at the same time, or covered, as circumstances may require.

If a field of this soil has more than one hollow in it, in that case it is necessary to have more than one drain; but if it is almost level, or inclines only a little to one side, a ditch or drain at the lowest extremity, having the ridges and furrows properly formed, will answer the purpose effectually, as is shown by *figs.* 5. and 6. of the same plate.

In some cases, however, it may be necessary to have a few side-cuts from the main drain, where the field is large or very flat, cut down also a little into the clay as narrow as it is possible to dig them, and filled with stones in the usual manner.

Such is the method of draining these soils with most advantage; but many fields suffer equally from wetness that consist of soil exactly opposite to the former; viz. a clay surface having a porous substratum. The drainage of such ground, where the wetness is still of a more injurious nature, and where the impervious stratum that upholds the water is of such a thickness as to require being perforated by the auger, has been already fully described; but here the depth of the drain being sufficient to reach the porous subsoil, without the help of boring, the description of such may with more propriety be introduced under this head. Fields of this kind commonly lie very flat, without any declivity, whereby the noxious water, stagnant on the clay-surface, might naturally discharge itself without the help of drains; for soils of the same nature, in a hanging situation, are seldom or never affected by the same cause. Such ground is more difficult to drain, and requires a greater number of cuts, than any other soil whatever, as they must be so laid out and conducted as to collect all the water from the surface, which can only discharge itself into the drains from above, being unable to flow into them through the clay; as in those soils of an opposite description, and where there is any irregularity in the grounds, the water will remain standing in the hollows within a few feet of the drain. The first thing is to make one main conductor in the lowest part, or at one end of the field, to receive and carry off the water collected by the smaller collateral cuts which it may be requisite to make on each side of it. If it suits the situation or division of the field, this main drain had better be open than covered, and then the outlets of the other drains that fall into it can easily be inspected, and frequently cleared out, as occasion may require.

The proper formation of the ridges, to answer the declivity of the ground, should be particularly attended to in such soils. The ridges should have rise enough in the middle to give the water a fall into the furrows, and these should have depth and fall enough to convey it into the drains. Thus would a great part of the rain-water, as it falls, be carried off, which would lessen the number of small cuts, otherwise necessary. The drains should all be dug as narrow as possible, and filled up in the usual manner, with loose stones; only the bottom of the conducting drain (if it is not an open one) should be formed in the manner already described, with a small open conduit at bottom, the more easily to carry off the water. The small drains should also be coupled at bottom, or have two of the largest stones laid in the bottom, inclining one on another above, forming a triangular opening of four or six inches below, in the way that has been described. As the water is all received in at the top of these drains, it is necessary that they should be filled with small stones so near to the surface as to leave only a space to be filled with loose gravel, sufficiently deep to prevent the plough or harrow from deranging them. Loose gravel, if it is at hand, is better than the stiff clay that came out of the drain, as it more easily admits the water to absorb through it into the stones, and the other can be spread on any adjacent hollow in the field. A thin layer of straw or rushes, (or, if the field is in pasture, the upper turfs pared thinly off will answer this purpose better than straw or rushes), should be laid immediately above the stones, to prevent the smaller part of the gravel from filling up too closely the interstices between them; but this is not so requisite when gravel is used in place of the mould. This mode of draining is calculated for very tenacious clay soils, whether porous below or not; but in many instances the deepening of the furrows, with very few drains, might remedy the evil, where the retentive upper soil is only a foot or two deep, with a porous subsoil under it, through which the water would easily subside downwards, and again empty itself at some lower extremity of the field. The drains and furrows should therefore be deepened through the clay to the open soil, in order to facilitate the descent of the water: and thus much depends on the proper ploughing of such ground: by attention to which many drains, otherwise necessary, might be saved. The mode of draining these soils, which is here described, is that, Mr. Johnstone says, which has been recommended as the most effectual by Mr. Elkington, though it does not properly belong to his system of practice.

The Essex mode of executing the drainage in ploughed spongy lands, where the surface soil is tenacious, as stated by Mr. Kent, is shown at *fig.* 3, in *pl.* XXV. The principal declination of the land is shown by *a* and *b*. *Fig.* 4, shows a field drained by means of one of its ditches, in the room of a main drain. *Fig.* 5, a field drained by a main drain cut in the middle, declining more at that part, than the sides. *Fig.* 6, a field drained by two outside main drains, the land being higher in the middle, than on the sides.

Draining of Land, where the Soil is stiff and retentive, by Means of open Cuts, and the proper Formation of Ridges and Furrows.

It has already been hinted, that on some soils, where the surface is very retentive, no number of covered drains can operate effectually in drying the ground. It is asserted, that in most of the central counties of England, and also in Flanders, the general mode of drying land is by ploughing it up in high and broad ridges, from twenty to thirty, and even forty feet wide, with the centre or crown three or four feet higher than the furrows. The successful practice of the Flemings shows clearly how effective this method is when well executed; for, by attentively keeping the furrows perfectly free from water, the land is kept in so dry a state, that all sorts of crops flourish remarkably well. But in England the same observation would not be just, for want of the same attention to this mode of practice. In many instances furrows are not properly directed, nor properly deepened, and the ridges are too flat: by which the water stagnates in the hollows, and of course renders that part of the field worse than lost. This bad management has brought the method itself

into such discredit, that in many places they have been levelling their ridges at a considerable expense, in order to adopt some other method of draining—an operation which, on clay soils, is certainly very imprudent; for, when the ridges are well rounded, not too high, and the furrows kept open, and perfectly free from retaining water, it must be esteemed, for land of a very retentive surface, an excellent mode of draining, or keeping it dry.

Much, it is remarked, has been written against high ridges, but not with due consideration of their propriety in such land; they have been applied on dry loams most absurdly; and from being perhaps a custom in that part of the country, no discrimination has been made: but their being improper in some cases, and ill managed in others, certainly affords no just argument against them, when well adapted to the soil and wetness of climate. They prove of great utility, even although united with either open surface cuts or hollow drains, as will appear, Mr. Johnstone says, from the following information that has been transmitted to the Board of Agriculture on this subject.

Mr. Francis Goade, of Cossington in Leicestershire, has united in this manner the ridge method, and hollow drains, in the furrows, and with a success that renders his account highly interesting. He observes, that his soil is sandy on the surface, from six to ten inches deep, red clay at the bottom, and in some places gravel, which throws the water upon the surface of the land; which soil he finds not easily drained by cross cuts, but requires hollow drains to be made in the furrows of the ridges, which are made from five to ten yards broad. Their height varies; for summer corn he raises them six inches, but for winter crops twelve at the crowns, above the bottom of the furrows. The hollow drains are thus dug: In turf ground, he makes the drain fifteen inches wide, and two feet deep, going down sloping: he first takes the spade and cuts a turf out; then makes use of another tool, made on purpose, something like a cheese-taster, (at the head, where the man sets his foot, it is seven inches wide, going narrower downwards to the length of sixteen inches), with which he digs out the other materials, whether it be sand, gravel, or clay. If clay, they cut four inches deeper in the middle at the bottom of the drain, and four inches wide, leaving two inches on each side, or what they call shoulders, to support the turf, which is laid flat upon it, with the grass downwards; then fill it up again. If the land is of a mixed soil, such as sand, gravel, &c. it must be laid with thorns or elder boughs, trampled down, and the turf laid upon them as before, close to the sides of the drain, so that it makes as it were a wall; but where slab, slate, or stone, can be had, it is still firmer. The bottom of the drain is about four inches wide, and workmen have a tool made the same way as a hoe, or in the form of the letter L, with a half round at the bottom, to scoop out the small particles of earth that remain at the bottom of the drain; how long they will last good is unknown: but he can answer for fifteen years, and expects them to endure a much longer time even filled with bushes; and the improvement may, upon an average, be estimated at one-fourth increase in the crops.

The mode of ridging and cross-throughing (furrowing) land, as practised in the Carse of Gowrie, Perthshire, is described in the following manner by George Paterson, Esq. of Castle Huntly in that county:—As clay is perfectly impervious to water, surface-draining is the only means by which the species of improvement can be accomplished, and all over the Carse of Gowrie this operation is extremely simple. There are certain large common drains which pass through the district in different directions, sufficiently capacious to receive the water drained from the fields by the ditches which surround them, and of such a level as to carry it clear off, and to empty their contents into the river Tay. There are also ditches which surround every farm, or pass through them, as their situation may require, but in such a manner as to communicate with every field upon the farm. These ditches are made from two to four feet wide at top, and from one and a half to one foot at bottom, in a shape which prevents their sides from falling in; but even then they must be cleansed, and scoured every year at a considerable expense. If the fields be of an uniform level surface, the common furrows between the ridges, provided they be sufficiently deepened at their extremities, will serve to lay the grounds dry; but as it seldom happens that any field is so completely free of inequalities, the last operation, after it is sown and harrowed in, is to draw a furrow with the plough through every hollow in the field, which lie in such a direction that it can be guided through them, so as to make a free communication with any of the ditches which surround the farm, or with any of the furrows between the ridges which may serve as a conductor to carry the water off to the surrounding ditches. When this track is once opened with the plough, it is widened, cleared out, and so shaped with the spade, that it may run no risk of filling up. Its width from six inches to a foot, according to its depth, which must depend upon the level of the field; but the breadth of a spade at bottom is a good general rule. It frequently happens that there are inequalities in several parts of the same field, which do not extend across it, or which do not pass through it in any direction that a plough can follow, but which may extend over two ridges or one ridge, or even a part of a ridge: such require an open communication to be made with any furrow which may serve as a conductor to carry off the water, which are always made with the spade. All these open communications are here called *gaas*, and to keep them perfectly clear is a very essential part of every Carse farmer's attention.

It is as yet the general practice in the Carse to have head-ridges, as they are called, at the two extremities of each field, *i. e.* the rising ground upon which the plough turns is laid up in the shape of a transverse ridge, higher in the middle, and falling off at each side; so that a *gaa* is made in the course of the inner furrow, with which the whole furrows

between the longitudinal ridges communicate, and into which they pour all their surface water, which is carried off by similar *gaas* or openings, cut through the head-ridges at convenient distances, and by which the whole is emptied into the adjoining ditches, and by them into the main drain.

It is supposed, that it would be a much better plan, instead of forming head-ridges as above described, to lay the earth up to the ends of the longitudinal ridges, uniformly, which could easily be done, with a little more trouble, by returning with an empty plough. There would then be no depression between the longitudinal and transverse ridges, of course no occasion for a *gau;* and by cutting fairly through the head-ridges opposite to every longitudinal furrow, a freer passage would be given to the surface water from the whole field to the adjoining ditch, and of course the draining be more complete. This method Mr. Paterson has followed with success upon all the fields he has levelled.

Besides all this, an experienced Carse farmer takes care, he says, that his grounds are carefully ploughed; that the land is laid up equally; that no inequalities are left so as to hold water; that the ridges are properly rounded, neither too high nor too low, but as near as possible to the section of a large circle, by which the surface water will easily drain off without lodging; and, while the crowns are not too much enriched, nor the furrows impoverished, the whole will be made equally fertile, dry, and prolific, and not unfrequently be accessible to the plough earlier in the spring than the fields upon the declivities of the surrounding hills.

On sheep-pastures, the carrying off surface water may be effected in the following simple manner: After turning up furrows through the hollow parts of the field where the water is apt to stagnate, by means of a strong common plough, let a man with a spade pare off the loose soil, leaving the inverted sod or turf grassy-side downwards about three inches thick; this done, let him turn over the sod into the furrow, grass-side upwards. By this a canal or opening of three or four inches will be left in the bottom of the furrow, sufficient to discharge a considerable quantity of water, which will readily subside into it. A great extent of ground may soon be gone over in this way; and, when the furrows choke or grow up, the same operation can be repeated at a very little expense.

Draining of Mines, Quarries, Marl-Pits, &c.

It is remarked by Mr. Johnstone, that the principles of the system of draining, which have been described, have hitherto been confined only to the draining of land, or taking away subjacent water that injures its surface; but there is no doubt, he thinks, that it might be equally successful, and of very material importance, in the case of mines and quarries, by diminishing the quantity of water that is frequently found in the course of working them, and which very much obstructs and even sometimes puts a stop to the work altogether; at least it very often does so in quarries of free-stone, lime-stone, marl, &c. and thus, from the want of this method being known, many mines and quarries at present lie unwrought, from the fear of water and quicksands, which might otherwise be wrought to advantage. It is well known that all springs and subterraneous collections of water are supplied from ground lying higher than that where they are found, which, being of a porous nature, admits the rain to filtrate through it, which descends often to a very great depth through the pores of the open soil, rock, sand, gravel, &c. before it becomes obstructed by some impenetrable stratum. Thus, in sinking a pit for coal, or any other subterraneous mineral near the bottom of a hill or high ground, a bed of quick-sand is often met with, so full of water, that to pass through it becomes a very difficult and expensive operation; and as this water proceeds from the porous ground lying above it, it may in many cases be practicable to intercept the greater part of that water before it reaches the sand-bed in the pit, and by means of tapping at the tail of the sand-bank (provided the ground naturally declines lower than where the sand is found in the pit) the whole of the water may be extracted from it, at a comparatively small expense with what is used as the common remedy in like cases. To accomplish this, in ascending from the pit, carefully examine, if, higher on the declivity, any bed of rock, sand, or gravel, *tails out*, which may convey the water contained in it to the sand-bed below; and if such bed is found, a drain may be cut into it, which will carry off a great part of the water, and consequently lessen the quantity in the mine; which would otherwise have continued to descend, through the porous substrata, before being thus intercepted in its descent. But, although this is done, and the supply from above entirely cut off, yet a sufficient quantity of water to injure the pit may continue to ooze from the sides of the sand-bed, even supposing it should dip towards the lower ground, which if it does, that water may be easily drawn off at some point in the low ground. To effect this, in order to remove the above inconvenience, in descending from the pit along the declivity, endeavour to discover at what place in the low ground the sand terminates or *tails out*, which may be found by means of a spirit-level; and if there is any appearance there of the water's having a natural outlet, it may, by means of a deep drain, be much quicker and more effectually drawn off: for springs naturally flow through narrow and crooked perforations, and consequently, whenever the orifice is enlarged, or made lower, the discharge of water becomes greater: but if there is a deep covering of clay above the tail of the sand, in that case a drain can only be cut so far into it; and, by means of boring through the remaining portion of clay, an easy outlet may be given to the whole water contained in the above sand-bed. This will also in a great measure remove or at least relieve the difficulty that would afterwards have attended sinking the pit; for the water thus cut off must lessen the quantity that would have been found deeper, the same body perhaps passing downwards from stratum to stratum, so far as they continue porous, or capable of receiving it. It is therefore of material

consequence to drain all ground lying higher and contiguous to mines, or any other deep subterraneous pits, for the reasons already given; and on these principles, and by these means, it may be accomplished with little difficulty or expense. The water found in the bottom of the pit or mine must be got rid of in a different manner, as the ground may perhaps no where decline lower than the mouth of the pit. For it is only on the supposition of the different strata and sand-bed *dipping* with the natural inclination of the surface, that the above method of proceeding is practicable, or on the supposition of their lying nearly horizontal: but should they lie in a reverse direction, there is little possibility of accomplishing the object, unless their termination can be hit on somewhere on the opposite side of the hill, which, by ascertaining the precise inclination of the metals, and by exact levelling, may very nearly be found out. In most cases, however, the upper strata above the coal are found lying pretty regular. But as a description alone, without an explanatory sketch, cannot convey so clearly an idea of the nature of this, *fig.* 7, of *pl.* XXVI. will help to elucidate the matter.

The foregoing observations so far explain how the water may be cut off that is met with in sinking the shaft, before reaching the coal or other mineral that is sought for:—The water that is found in the bottom of the pit, that proceeds from the rocks, &c. in the course of working the mine, is commonly got rid of by means of an engine-pump; to assist in working which, the water obtained by means of the drains already described may be very useful, where the stream for that purpose is deficient, in saving the great expense of working it by steam. And that letting down the water by boring into an inferior open stratum, even in the bottom of the pit, may not only be practicable in some cases, but of very great advantage, the following observations contained in the Agricultural Report of Hertfordshire will show: The water was raised by a steam-engine about sixty yards from a colliery in Yorkshire, which had been wrought several years; the proprietors bored down to the depth of almost ten yards farther to ascertain the depth and thickness of a seam of coals, which was supposed to lie below those then wrought: the workmen employed bored from the bottom of the pit to the next engine-pit; and when they had bored to the above depth, and taken out the rods, the water from the works, which usually ran across the bottom of this pit to the engine-pump, ran down the hole they had made. As soon afterwards as the steam-engine was set to work, at the stated period (about one hour in twelve) the engine-pump contained little or no water; it had escaped through this hole, and continued to run through the same ever afterwards, and rendered the engine useless. This instance of water at so great a depth from the surface finding a passage at a farther depth of ten yards or less, and immediately below, is very singular and striking. The situation was much higher than the next adjoining valleys and the level of the sea. Experiments of this sort seldom fall to the lot of man to make; therefore such instances are rare and uncommon. But in large tracts of level land, where lakes or morasses have been formed, and which cannot be drained by cutting open drains, or driving levels through rocks, but at an expense for which the lands when drained would never compensate, the above instances warrant experiments being tried with bore-rods, which, if not successful, may be tried at little expense.

But without the help of a natural stream, which may be converted to the above purpose, it is seldom possible to find, by means of drains or otherwise, a quantity of water sufficient to drive such weighty machinery, in a situation high enough to have the necessary command of it. It may, however, in many cases, be a valuable acquisition, as is shown at *fig.* 8. *pl.* XXVI.

In a situation where a proper command of water can be obtained, and where the entrance to the mine is likewise adapted for the purpose, the use to which it may be converted is still more advantageous, by driving machinery to bring out the minerals, and also for working an engine-pump for clearing the mine of subterraneous water, flowing from the cavities of the rocks that are met with in working. His Grace the Duke of Buccleugh's coal-works, near Langholm, in Dumfriesshire, afford a striking example of this, and of the superior powers of water and machinery when properly combined, where a command of the former can be obtained, and when the latter is constructed on proper principles, and conducted with that care and ingenuity which are necessary in such undertakings.

It frequently occurs, in working quarries of lime or free-stone, that, at a certain depth, part of the rock containing water is hit on, whereby the quarry is soon so filled with water, as to put a stop to working it deeper, where the best of the stone lies. The common remedy in such cases is, either to erect a windmill-pump to draw out part of the water, (for the whole cannot be taken away by this means) or to open a new quarry adjoining to the last, which, at the same depth, meets with the like obstruction, or to bring up a very deep and often expensive cut, under the level of the water, from the nearest declivity. By the following method, however, all quarries of lime-stone, free-stone, marl, &c. liable to such an obstruction, may be completely cleared of water at little expense; and the drain at the same time will serve a double purpose, by drying the wet ground, which, in consequence of the spring contained in the rock, is found adjoining to it.

Immediately under the rock commonly lies a bed of retentive clay that upholds all the water received by and retained in that rock, and which being also bound round on each side by a covering of clay or other stiff soil, cannot discharge itself, and therefore stands always so full in the rock, as to prevent taking out the stone to the bottom.

In the first place, in such cases, endeavour to find to what side the rock dips or inclines, which may easily be found by the appearance of the surface in examining the adjacent ground, and by the assistance

of a spirit-level. After discovering this, cut a drain through the clay covering to the rock, by which the water will be drawn off, that, for want of a proper outlet, formerly stood pent up in the cavities of the stone, as is represented at *figs.* 1. and 2. *pl.* XXVII. Sometimes the evil may be remedied in a different manner. It often happens that a bed of the same stone, of a close compact nature, is found lying under one of a more open kind with pores and fissures in it admissible of water, which so keeps up the water in the open bed, that none of it can pass through to an inferior open stratum; and on sinking through this stone another bed is found of so open and porous a nature, as to admit the reception of any water from above that may come into contact with it.

Sometimes a bed of gravel or sand is found under the close stone, which, being still more capable of absorbing any water let down to it, is better calculated for the purpose of clearing the upper bed of stone from water, than a stratum of open stone itself.

When this is discovered to be the case, and the water kept up by the second bed of stone so as to be prejudicial to the working of the upper bed, and which will be equally so in working the second, the work may be greatly relieved by boring through the close bed of stone, and letting down the water into the more porous one below, or into a stratum of dry sand or gravel, if there be such under it: in place of boring, sinking small pits through the close stone is a more effectual method of letting down the water, but a more difficult one to execute. At Ormskirk, in Lancashire, stone-quarries are cleared of water exactly in the manner above described, but which *fig.* 3. *pl.* XXVII. will better explain.

In stone-quarries, wells (pits) are occasionally sunken, Mr. Ecclestone says, to the open bed, which have proved highly serviceable. This mode was practised in a stone-delf, near the above place, with success. But in order to lay the delf more effectually dry to a greater depth, on viewing the ground, Mr. Elkington marked where he thought the rock terminated or tailed out, and at the lowest level set out the drain to be cut up to the rock, part of which work is executed, and a very considerable spring comes from it; but on account of the great depth (sixteen feet) it will not be finished before he has seen the work again. The drain he has laid out is about ten feet lower than the bottom of the stone-quarry, and, when completed, will lay that bed of stone dry lower than the present floor. All rocks mostly where they terminate are succeeded by broken loose stones of the same nature as the rock, and they are, he says, frequently (not to say always) succeeded by sand, which, when a thick bed, and of a running nature, (quicksands) often cause great expense to cut through to the tail-end of any rock, as may be seen by *fig.* 4. *pl.* XXVII. In such cases as this, where there is danger of meeting a quicksand, boring or sinking pits through the bed of close stone is the most advisable and least expensive method.

The situation of marl-pits is commonly such, that it requires a very expensive cut through some part of the surrounding bank to carry off the water that prevents the taking out the marl. This might often be accomplished in a much less expensive manner, by sinking a pit through the retaining stratum under the marl-bed into some absorbent stratum below, that would receive the water let down into it by the pit. If the ground where the marl lies is of considerable extent, several pits will be necessary to carry off the water. If they require to be so deep as to be in danger of falling in, they should be built round the sides, or filled up to near the top, with loose stones, through which the water can subside. Any cross-drains or cuts necessary for collecting the water must be conducted into the pits. In many cases, the water may be got rid of in a still easier manner, provided the situation of the ground is answerable. If the surrounding bank declines on the opposite side lower than the water, by cutting a drain into it, and boring with a horizontal auger into the tail of the stratum containing the water, it will be drawn off and reduced to a level lower than that of the bed of marl. As this water is often supplied by a spring, rising in some part of the higher ground, and descending into the place where the marl lies, in such cases it will be necessary to cut off the source of the spring, and divert it into some other channel. By doing this, the quantity of water below will be lessened, and more easily carried off by means of the pits or drains.

In draining wetness, caused by mineral strata, some circumstances are to be more particularly attended to, as is evident from the annexed plan of performing the work given by Mr. Johnstone, in second edition of his account of Mr. Elkington's method of draining land.

The plan of draining wetnesses, on the tops of hills and banks, contiguous to low grounds, but supplied from high lands at some distance, by means of metallic substrata, is shewn in the same plate, at *fig.* 4. The strata *C. D.* continue on some rise in high ground north of rivulet to higher level than line *A. B.* by which springs *E.* and *F.* from the crop of the metals, are supplied. An outlet will be obtained by a cut from a rivulet to bank *G.* free of the former, and by boring or sinking: pit from *H.* to *I.* the water passing through porous strata from *C. D.* to *E. F.* will be reduced to the level *L. M.*; of course the source of springs *E. F.* be cut off, and ground on the tops and sides of the hill become dry; and metals to that depth wrought without inconvenience from water, which could not be done by boring in the bottom of the rivulet, as shewn by dotted line. When strata *K.* crop out to the surface and produce wetness, the pit or bore *H. I.* may be continued till it reach it when necessary.

Mr. Johnstone observes, in concluding his account of Mr. Elkington's mode of removing the wetness of land, that of all the improvements by which intelligent husbandry has advanced the value of land, to the equal benefit of the owner, occupier, and to the public, there is not perhaps any

other from which so many advantages have been derived at so moderate an expense, as that of draining. Soils that are wet from springs, or from rain-water, are equally unproductive, till laid dry. Seasons of tillage are lost if the land is not in an arable state, and in very wet years its produce is scanty and precarious; but when well drained, all other exertions of good husbandry are attended with beneficial consequences, and take full effect. The farmer thrives on the same farm on which his predecessor was ruined. Of its effects on grass-land, lord Petre observes, that "the land after draining, not being so much chilled by the long continuance of the winter-water on the surface, produces earlier vegetation in the spring, the grass is rendered of a better kind, the white-clover is encouraged, which seldom fails in Hertfordshire and Essex to chequer the land-ditched fields with its sweet appearance." And again, "tillage-land is much more manageable; it dries gradually and early in the spring. The bad effects of land being catched full of water, when the parching winds in March suddenly harden the surface of wet grounds, is prevented, and the earth breaks kindly. This in a short time alters the very nature of the soil; the weeds and grasses change their colour; every plant that grows loses the appearance of rankness; the corn increases in quantity and weight; and every benefit a farmer can wish is more or less the consequence of this first of all improvements, in proportion as the soil draws well or ill."

Respecting the further consequences of the practice on arable land, he likewise observes, "the great advantage of land-draining is, that we can plough earlier in the spring, and later in the autumn; and it certainly makes the land tilth easier, and it can be kept clean with less expense. But it is too much for the farmer to expect his return the first crop. He believes he knows some particular pieces that have repaid the expense in two crops. It certainly is a very beneficial improvement to the farmer." Mr. Young, of Clare, says, that "he has a field that used to be so wet and poachy in the winter as not to be able to bear the weight of a sheep; he land-drained and fallowed it, then sowed it with wheat, without manure, and had a crop equal to half the value of the land." And, in speaking of the improvements in the county of Essex, Mr. Vancouver has the following remark on the importance of draining: "There is no improvement to which the heavy-land husbandry of this county owes so much, as to the fortunate introduction and continuance of the practice of hollow-draining. The means of melioration, and the consequent sources of fertility thence derived from the soil, over and above what it formerly yielded, are not more important and valuable in the present day, than permanent and precious, as they must prove in their consequences hereafter. The few instances of invincible blindness to the beneficial effects of this excellent practice go, he thinks, no farther than to prove, that where the work is not properly executed, it ever ceases to fail in producing the desired effect."

Hollow, or Under-Draining, the art of soughing, or making covered drains.—In making these drains, sufficient attention seems not to have been, in general, paid to the springs which take their origin from some main one, which, being cut off, would drain a considerable tract of land below the spot where it rises, as has been already explained and exemplified.

From want of due attention to this necessary discrimination, it is common in Essex, Suffolk, and other counties where under-draining is very generally performed, to see many superfluous drains marked out in directions where they can have very little effect, and where a single one well directed would have completely dried the field. As the expense which might thus be saved is an object of consequence, too much attention cannot be paid to the matter.

That the Romans were not unacquainted with most of the modern methods of hollow-draining, Mr. Johnstone thinks, appears from all their writers *de re rustica*, as Cato, Palladius, Columella, and Pliny mention them particularly, and describe some circumstances which have lately been considered as modern improvements. Upon strong tenacious land, where the water could only be received at top, they preferred open-drains; on other soils, where the water could be drawn equally from both sides, or could rise from the bottom, they used covered ones. They knew, he asserts, the propriety of directing them obliquely across the slope of the field, a point in which modern drainers are often erroneous. Their general depth was from three to four feet, filled half-way up with small stones; for want of these with willow-poles, and even with the spray of wood twisted into a rope, one of the latest practices with straw that has taken place in this country. Of that material, also, the Roman farmers availed themselves, when others were wanting. The ends of their drains they were careful in fortifying with larger stones, in form of bridges, and the mouths or outlets were laid in masonry, a circumstance in which Mr. Whyn Baker, of Ireland, thought himself original.

From the depth, it appears that their drains were designed to carry off the water of springs as well as that caused by rain on a flat or retentive surface-soil, for both which they were in some cases equally well adapted.

To the proper direction of the water-furrows, in order to convey all surface-water into the drains, and to the clearing and cleaning out of the ditches round the fields, they paid particular attention. These circumstances are sufficient to prove, he says, that the Romans understood the business of common draining in great perfection, and that our best cultivated counties had little to boast of in this respect, in superiority to the ancients, till Mr. Elkington made the discovery of a method with which they were wholly unacquainted. The best French writer on

agriculture, De Serres, who wrote in 1600 his Théâtre d'Agriculture, describes hollow-drains particularly: they were filled with stones.

It would, however, demand a very careful perusal of all the earlier writers on husbandry, he says, to ascertain when this practice was first introduced into this country; but a circumstance occurred in Sussex, which shows that hollow-draining was in use long before any mention would be found of it, were such authors consulted, as no notice of it occurs in either Fitzherbert or Norden. In 1770, Mr. Poole of that country informed a farming traveller, "that near one hundred years ago, a very large oak, two hundred years old, was cut down at Hook. In digging a ditch through the spot where the old stump was, on taking up the remains of it, a drain was discovered under it, filled with alder-branches; and it is remarkable that the alder was perfectly sound, the greenness of the bark was preserved, and even some leaves were found. On taking them out, they, however, presently dropped to powder. It is hence very evident, that underground draining was practised three hundred years ago in this kingdom. We find also, that alder is, of all other wood, the best for filling drains. Probably no other, except aquatic plants, would endure nearly so long. Bushes, as has been seen, are generally used, but sallow or willow is probably much better." The Board of Agriculture has been informed by Richard Preston, Esq. that land drained according to the present practice is not more than forty years standing in his neighbourhood in Essex. This deserves inquiry, for it is generally supposed to have been used there long before such a period.

The methods of managing springs that proceed from water at any considerable depth in the earth, or which break out from the variation of certain strata, in hills which demand deep cutting and the use of the auger to work their cure, have already been considered. Hollow or under-drains, that come under the present description, are chiefly used to correct that wetness of soil which results from rain, and which from flatness of surface, or its retentive quality, stagnates, to the injury of both soil and crops. This is the most general nature of the evil which these drains are intended to remedy, but by no means exclusively of that caused by land-springs, whose seat apparently is not below their depth. The wetness proceeding from such is, in some cases, removed by these drains, when deep enough cut, and properly directed; but in many others, from ignorance in the drainer, great sums of money are thrown away for want of attending properly to the nature of the evil, and of distinguishing betwixt *surface-water only*, and the *oozing of land-springs*.

In soils that are so tenacious as to retain water on the surface till evaporation carries it off, such as are found in Sussex, Surry, and in many other counties, this method of draining has been tried, and found entirely to fail. The cause of this can easily be accounted for. Very stiff clay will hold water *like a dish* (the expression of the farmers in those counties, who have attempted to drain such soil), and consequently the small portion of water which each drain will carry off, is only what falls immediately above it, or what it can receive at top, when the ground on each side has a descent towards it. The water being all *on the surface* cannot find its way into them. If they are on a declivity, the water will run over them, as it does over any other part of the field; and if they are in a hollow, it will stagnate even above them. This is, therefore, a more expensive soil to drain, requiring a greater number of trenches, and these very closely together, than any other soil whatever; open trenches, with the ridges and water-furrows properly formed and directed, is the only method whereby its drainage can be effectually accomplished. It is necessary to lay it up in ridges properly placed, and to cut *small open-drains* across the ridges where requisite, communicating with each other, and with the furrows, and thus all the water-furrows operate as drains. The water, as it falls upon the ridge, immediately makes its way into the furrows, and runs along them while there is a descent; and, if it is stopped in any of them by the ground rising, is conveyed by the drains across the ridges into some other furrow where there is a descent, along which it makes its way into some ditch or water-course at the extremity of the field.

In Essex and in Suffolk, where it has been found advantageous, the soil is a wet poachy loam, more or less mixed on the surface with vegetable mould; under that, in some places, a raw hungry loam, and in others a clay marl.

On these soils the effect is very great; for the upper stratum, where the moisture is chiefly lodged, being in some degree porous, the water is easily extracted from it by means of the drains. The under-stratum being also of a retentive quality, their depth does not require to be great.

For the making of hollow or under-drains, the instruments which have been long in common use in the eastern parts of the kingdom are extremely simple. While the depths of the drains were more considerable than at present, three spades, as has been seen, were in use to succeed one another, lessening in breadth gradually, in such a manner as to form a regular contraction to the bottom; but of later years cheaper and easier methods have been pursued. By previous ploughing, all the spades except the lower one have been laid aside; and where a greater depth than common has been required, not more than two have been used. A scoop is also pushed or drawn along the bottom of the drain, to clear out the loose mould, and prepare it for the materials used in filling, which varies in size and breadth according to the width of the drain. See *Draining-Scoop* and *Spades*.

Draining-*Auger*. See *Auger*.

Horizontal Draining-*Auger*. See *Auger*.

Draining-*Bricks*, such sort of bricks as are formed for the purpose of making hollow-drains with. There are several kinds of bricks made use of in this business, besides those of the common sort, where the

expense of stone is too great. Some of the most useful kinds are represented in the annexed plate, at *figs.* 1, 2, and 3. The first of which is chiefly made use of when small drains only are required, as for conveying water to houses, &c. The other two are well adapted for the making of larger drains, particularly the third, invented by Mr. Couchman, of Bosworth-Temple, in Warwickshire, and are generally laid singly, without common bricks being placed under them, in the stiff kinds of soil; but where it is sandy, it is better to lay common bricks under their sides, to prevent their sinking.

Another sort of draining-brick has been invented by Mr. Ashworth, of Turton, near Bolton, in Lancashire. At *fig.* 4, is shown the form and manner of placing the bricks in his mode, in which eighty-four bricks are required to every eight yards, while with common bricks one hundred and ninety-two are necessary; of course, there is a saving of one hundred and eight in this way in every eight yards of draining.

Fig. 5, is another form of brick, in which fifty-five bricks are sufficient for draining eight yards in length; by which one hundred and thirty-seven bricks are saved in that distance. *Fig.* 6, is a form which takes one hundred and ten bricks to complete a drain of the same length, by which eighty-two bricks are saved. This form is only necessary where much water is to be conveyed away. *Fig.* 7, is another form, which employs and saves bricks in the same proportions as *fig.* 4. *Fig.* 8, is another form of brick that employs and saves in the proportions of *fig.* 6. It is particularly useful in draining boggy soft lands, and where there are quicksands. *Fig.* 9, is another form that saves bricks, as in *fig.* 5. *Fig.* 10, another form that takes the same as in *figs.* 5 and 6. *Fig.* 11, is a cross section of one of the bricks, seven inches broad and two in thickness. The perpendicular line from *A* to *B* is one inch; the slope from *B* to *C* one inch and a quarter; the distance from *A* to *D* by a perpendicular line from *C* is full half an inch. The perpendicular line from *E* to *F* is three-quarters of an inch. The slope from *F* to *G* is full two inches and a quarter; the distance from *E* to *H* by perpendicular line from *G* is two inches. *Fig.* 12, a full length view of the brick, exhibiting the narrowest slope. It is ten inches from *I* to *K*. *Fig.* 13, is another whole length view of the same brick the contrary way, presenting the broadest slope.

Draining-*Level.* See *Level.*

Draining *Spirit-Level.* See *Level.*

American Draining-*Level.* See *Level.*

Draining-*Scoop*, a crooked kind of tool made use of in some cases for clearing out the loose materials from the bottoms of drains. This sort of implement is formed of different sizes and breadths, according to the drains; and, in working, is drawn or pushed along the bottom. It is represented at *fig.* 13. *pl.* XXII. *Fig.* 14, is another form of it.

Draining-*Shovel*, another sort of implement employed for the same purpose as the above. It is made with a crooked handle, and the edge of the shovel-part is turned up, in order to prevent the materials scraped up from falling off. From the crookedness of the handle, the workmen are also prevented from stooping so much as would otherwise be the case when performing the business. See *fig.* 15. At *fig.* 16, is another form of it.

Draining-*Sod-Knife*, an implement made use of with great benefit in scoring or cutting out the sward in forming drains. It is seen at *fig.* 17.

Draining-*Spades*, such spades as are employed for the purpose of cutting out drains. They are made of different breadths, so as to follow each other, and cut the drains narrow at the bottoms. An upper and pointed draining-spade may be seen at *figs.* 18 and 19, and a wooden one to be employed in peat-soils at *fig.* 20.

Draining-*Straw-twisting Engine*, a machine of a very simple construction, and capable of being readily removed, contrived for the purpose of twisting straw into ropes, in order to the filling of drains with it. It is represented at *fig.* 12.

Draining-*Ploughs*, such ploughs as are contrived for the purpose of cutting drains, in order to carry off the water from wet soils. Various implements of this kind have been invented at different times for performing the necessary operations of draining; but perhaps none have yet been found sufficiently to answer the intention in all the varieties of soil on which they may be required.

A plough of this sort, invented by Mr. Cuthbert Clarke, of Belford, in Northumberland, which is shown in *pl.* XXIX. was found to answer exceedingly well in meadow-ground, but could not be drawn in a stiff clay with the force of eight horses. *Fig.* 1. is a perspective view of the whole implement seen on one side; *fig.* 2. another view seen in front; *fig.* 3. a third view seen at the tail; *fig.* 4. a section of the plough, to show the disposition of the three coulters. It must be observed, that the same letters refer to the same parts in all the different figures.

A, B, C, are the three coulters.

D, E, F, the nuts and screws that fasten the coulters to the beams.

G, H, I, a wheel, or rather roll, which prevents the plough from going deeper in the earth. This roll is divided into three parts, by circular pieces of iron, which project beyond the roll, and cut the turf into three parts. The coulters follow in the same track, and finish that part of the work.

K, K, the centres on which the roll turns.

L, L, the nut and screws which fasten the iron arbour, in which the pivots of the rolls turn to the beams. These arbours are kept in their proper places by means of the two iron braces *f*, *f*.

M, a large iron hook, to which the chain by which the instrument is drawn is fastened.

N, the tow-chain, or that by which the plough is drawn.

O, the head of the plough, into which the beams are mortised.

P, Q, R, the three beams.

S, a shoe of iron (the whole part from S to A being of that metal), and into which the hoof of the plough is inserted.

T, a shelf, on which the mould rises after it is cut up by the coulter and fore-part of the share, till it is thrown out of the trench by the mould-boards.

V, V, the mould-boards, which throw the earth out on each side the trench.

W, W, a band of iron, which fastens the after-part of the plough to the main or middle beam.

X, the head of a tenon, which fastens the mould-boards and hoof of the plough to the main beam.

Z, Z, the two handles, like those of a common plough.

a, *b*, a piece of board tenoned into the handles, in order to keep the handles in their proper position.

c, *d*, represents the surface of the ground when the plough is at work. Therefore all the parts below that dotted line are under the ground when the drain is cutting.

f, *e*, *g*, shows the angle which the coulters make with a line drawn parallel to the horizontal-plane; and is nearly equal to forty-five degrees.

The mode of operation in this plough is the same as that with the common plough. But it would seem that as the angle *f*, *e*, *g*, is greater than that by which the horses draw upwards, it must have too great a tendency to get into the earth; the consequence of which is, that, when the soil is very stiff, it requires a very great force to draw it, and cannot be held down properly by the handles. The angle *f*, *e*, *g*, should probably therefore be lessened to about thirty-three degrees, which would in a great measure remove this difficulty. In marshy, boggy, and moory soils, it is said to answer the intention extremely well, and to make a clean trench. From its requiring very great strength of draught, it can, however, only be employed in particular cases.

Common Draining-*Plough*, a plough which is employed in some of the midland counties, for the more general purposes of draining, is a good, and not very expensive tool. At *fig.* 5. is a draining-plough of this sort, made use of in Leicestershire with advantage in different cases.

Draining-*Furrow-Plough*, is another plough of this class, which may be employed for making large open furrows, by which the water may be taken off from the surface of the land. It will be frequently found a necessary tool in those clayey soils where water stagnates on the surface of the ground, and which cannot be removed by the more general modes of under-draining; a plough of this kind, employed for opening the furrows on tillage-lands, is seen at *fig.* 6.

Draining-*Gutter-Plough*, is a plough of the same kind, made use of for forming gutter-drains in grass-lands. It is recommended by the Duke of Bridgewater, and is represented at *fig.* 7. in which *a*, *b*, is the beam; *c*, *d*, the handles; *e*, the share or sock; *f*, the coulter or first cutter of the sod, fixed to the share; *g*, the other coulter, or second cutter, which separates the sod from the land, and directs it through the space or opening between *f* and *g*; this coulter is connected with the share and beam; *h*, *i*, the sheath; *k*, the bridle or muzzle to which the swingletree is attached; *l*, *m*, two wheels of cast iron, which may be raised or lowered by screws at *n*, pressing upon the flat irons *o o*, to which the axis of each wheel is fixed—these wheels regulate the depth which the share is to penetrate into the earth; *p*, a chain with an iron pin to move the screws at *o*. It has been found useful in forming gutter-drains on grass-lands, where the soils are of a retentive nature. The power of six horses is required in drawing it in soils that have not been drained before; but in opening the old gutters, four horses are found sufficient for effecting the purpose.

Draining-*Mole-Plough*, a sort of plough made use of for the draining of grass-lands, where it is a material object not to have the surface injured; yet to have the moisture removed at particular wet seasons, as in parks and pleasure-grounds. It is a sort of draining-plough that has been said to answer well with six or eight horses. It was invented by Mr. Adam Scott. See *Mole-Plough*.

It is observed in the fifteenth volume of the Transactions of the Society for the Encouragement of Arts, that it has been used in Sutton-Park, for John Webbe Weston, Esq. these three years past, and is found to answer every purpose of under-ground draining, without breaking the surface any more than a thin coulter being drawn along, which mark disappears in a few days. A man and a boy, with four horses, may drain thirty acres in a day, provided there is an open grip or ditch cut at the lower side of the ground to be thus drained, in order to receive the water from those small cavities which the plough forms in the ground, at the depth of twelve inches, or more. The method of using it is, to go down and up, at the distance of fifteen, twenty, or thirty feet, as the land may require: this alludes to grass-land; but it is equally good in turnip-ground, where it is too wet for the sheep to feed them off, or on any land that is too wet to sow; either of which evils it will remedy in a very short time, provided there is some declivity in the ground. The best time for this operation, in grass-land, is in October or November, when the land has received moisture enough for the plough to work, and not so much as to injure the land, or render it soft. It is further remarked, that in a very light soil, but not sandy, to the depth of from nine to eighteen inches, or more, and underneath a strong clay, which rendered the surface absolutely poachy in winter, the use of this instrument made parts of the ground on which a man could not walk, in the course of forty-eight hours, be enabled to carry any cattle. The drains made by this plough should be in direct lines, at from ten to twenty feet apart, and all vent themselves into an open furrow, or grip, at the bottom, as just observed. It is most useful in such soils as oppose but little obstruction to it; and the chief objection to it is probably the great strength of team which it requires. The price of the plough, when complete, is about two guineas.

Under-Draining-*Plough*, a plough contrived for forming under-drains, somewhat in the manner of the mole-plough. It is represented at *fig.* 8. in which *a* is a small roller for regulating the depth;

b, a rolling coulter, to cut the turf or sward, or coarse herbage on the surface, and which may be removed where used on tillage-land; *c*, a flat share edged in front; *d*, bottom of share, rounded above, oval at the bottom, and pointed to make an opening for water; *e*, pin-head, for regulating share, so as to form drains of different depths; *f*, beam, which is strong and plated. It is also capable of being wrought by attaching a pair of wheels with the shafts, by a chain to the hook *g*.

DRAPE, a term applied to a barren animal.

Drape-*Cow*, a term applied to a farrow-cow, or one whose milk is just dried up.

Drape-*Ewe*, a term used to signify an ewe from which the lamb has been some time taken.

DRAUGHT, a provincial word signifying a team of either cattle or oxen.

Draught-*Horse*, a horse destined for the cart, plough, or some other team; for these purposes such horses should always be chosen, of whatever breed they may be, as are close, compact, and strongly made. They should neither be too small nor too large, but properly suited to the nature and situation of the farm or road on which they are to be employed; and where they are to draw together in a team, as nearly as possible of an equal size and height. See *Horse*.

In the feeding and management of draught-horses, much attention is requisite: the servant who looks after them ought to be up very early, in order to take away the old hay out of the rack, if any be left, and put fresh in, as well as to clean the manger from all sorts of filth; and while the horses are eating their hay, to take them one after another out of the stable to curry and dress them well.

It is probably as necessary that such horses be well cleaned and dressed as that they be well fed, as it is probably from the filth that is upon and about them, that many of the distempers to which they are liable have their rise; and it may be held as an invariable maxim, that a horse with less food, when properly dispensed, and well dressed and curried, will be in better condition than another who has more provender given him, but whose dressing is neglected.

When labouring horses have had a suitable quantity of good pure water, they must have their oats in a clean manger, which should be first well sifted and cleared from dust and other impurities, the quantity of which should be adapted to the hardness of the labour in which they are engaged, but always such as to keep them in good condition. At night, they should likewise constantly be littered down with good clean straw. In putting them into harness for every purpose, care should be taken to examine whether any thing hurts them, either at the breast, shoulders, or hams; and to see that the collars about their necks be supplied with every thing that is requisite for them: if they are to draw in a cart, see that the pad upon the back does not hurt them, that the same sits every way even, and that it be well stuffed with hair in the pannels. See *Horse* and *Team*.

DRENCH, in *farriery*, a large draught of any liquid remedy, given to a brute animal, by means of a horn properly cut for the purpose.

DRESSING, any sort of manure applied to land for the purpose of its improvement.

Top-Dressing, that sort of dressing which is sown over or applied upon the surface of the land, either when the crop is upon the ground or not. It also signifies the application of different sorts of reduced kinds of manures, such as soot, ashes, and various other dusty substances, either upon meadow and pasture-lands, or to the young crops in such as are in an arable state. See *Ashes* and *Peat-Ashes*.

It is observed by Mr. Donaldson, in his Modern Agriculture, that probably no part of the subject of manures requires more investigation than that of the advantages that may be derived from top-dressing, and the various sorts of manures that can be procured in different districts for that purpose. This would open, says he, a new field for the cultivation of lands, hitherto considered in a great measure barren; and it is presumed that the practice of the Hertfordshire farmers in this respect requires only to be known to be imitated where practicable. The following statements from the Agricultural Report of that county will, he thinks, show the advantages which the farmers derive from the practice of spring or top-dressing their crops. "The spring or top-dressings are the leading features of the Hertfordshire farming, and consist of soot, ashes, malt-dust, and oil-cake dust, or pulverized oil-cakes. The soot and ashes are brought principally from London, the malt-dust from Ware, Hertford, and other places, and the oil-cake dust from the different oil-mills in the county and neighbourhood. The soot is generally used on the wheat-crops, which have had no previous manure; it is laid in heaps on the fields in winter, and sown in the spring. The other top-dressings are housed and kept dry till used. The average price of the Hertfordshire top-dressings is, he says, as follows:

	Per statute acre.
30 Bushels soot, at 8*d.* is - -	£.1 0 0
Ashes, the carriage, the chief expense, may be about - -	0 10 0
10 Bushels oil-cake dust, at 2*s.* 6*d.*	1 5 0
40 Bushels malt-dust, at 1*s.* -	2 0 0

These top-dressings, it is asserted, not only supply the want of previous manure, but also, when crops are sickly and backward in the spring, occasioned either by bad seed-seasons, frost, or other causes, are attended with wonderful success, and enable the crops to vegetate quickly, and to cover and protect the soil on which they grow from the droughts of the ensuing summer. To their almost magical powers, says he, the Hertfordshire farmers are principally indebted for their never-failing crops. Without entering into chemical analysis to discover the cause, they are satisfied with the effects; and therefore continue to enlarge upon the practice, although attended with considerable expense. The provident farmer lays in a stock of these sorts of

manures to answer contingencies; and, provided with this treasure, he can remedy the evils of bad seed-times and seasons. These top or spring-dressings are peculiarly applicable to poor, light, sandy, and gravelly lands, and of course to the production of the specifically heaviest corn, and put such lands more on an equality, in point of annual value, with stronger and richer soils. Happy, says he, would it be to more distant farmers, and to agriculture in general, could an adequate substitute to the Hertfordshire dressings be procured at an easy expense, and the application of that substitute perfectly understood."

From these, as well as several other observations, the importance of farmers, not so fortunately situated in regard to the means of procuring large quantities of soot, malt-dust, &c. bestowing particular attention in finding out and using proper substitutes must, it is thought, be generally acknowledged. Of all others, none are, he conceives, likely to be procured in such quantities in the remote parts of the kingdom as the ashes of peat or turf; which, although not perhaps in every case possessing such valuable qualities as those procured in Berkshire, could not, he thinks, fail, if kept dry in houses constructed for the purpose till used, amply to repay any trifling expense that could be expended in preserving them in a proper state, and sowing them over the land in the spring. In short, he supposes, it would prove greatly in favour of agriculture, were farmers in general to be more assiduous in procuring this sort of manure, and more attentive in applying it. Were that the case, quarries of limestone and pits of marl would, he conceives, be discovered in almost every district; sea-sand and sea-weeds would be more generally used; and the best methods of recovering backward crops, by using top-dressings of various sorts, would be as generally known in other parts of the country as they are now in Hertfordshire and some neighbouring districts.

In the top-dressing of grass-lands, well rotted dung, and composts of dung and various earthy materials are for the most part employed, though other substances when well broken down and reduced might be used with advantage, proper attention being had to the nature of the land. See *Manures.*

Dressing *of Animals*, in *horsemanship*, the periodical application of friction, by means of brushes, cloths, &c. to the hides of animals, with a view to cleanliness as well as health. It is to the horse that this is chiefly applied; the inferior descriptions of cattle being left to rub off their impurities as well as they can, though it is also well known to be useful to them in promoting their condition.

Mr. Clark well observes, that "as exercise acts as an assistant to the heart in promoting the circulation of the fluids, so friction on the surface of the body, by means of the curry-comb and brush, contributes to forward the circulating fluids, and promote that insensible perspiration through the pores of the skin, which is so conducive to the health of the animal. The currying and brushing horses that are kept in stables is, he says, done not merely with a view of taking away the dust and dirt that may be collected on the hair; but, when properly performed, is a very beneficial operation to them, as they naturally perspire much through the pores of the skin. This appears indeed from the effects which result from the omission of it. When this operation is neglected, or slightly performed, the perspirable matter hardens in the pores; it remains at the roots of the hair, and has the appearance of a whitish or brownish dust, and sometimes like small scales, which, for the most part, creates an itching: the skin, at the same time, generally appears dry and hard, the hair stares or stands on end, instead of lying smooth and shining."

It has been remarked, even by Columella, that the bodies of cattle ought to be rubbed down daily, as well as the bodies of men; and that it oftentimes does them more good to have their backs well rubbed down, than their bellies filled with large quantities of provender.

And from what is known of the salutary effects of friction on the human body, it will be evident how much benefit may be derived to horses (if not to inferior cattle) from good rubbing and dressing as frequently as possible; but more especially when they are cold and chilly, after being over-heated, or from being suffered to stand in the cold air tied at the stable-door. Dressing becomes then the more necessary, as it produces a gentle heat and warmth all over the surface of the body, prevents stagnation of the fluids in the vessels on the surface, and promotes a free perspiration. But, though the greatest advantages may be derived to horses when in health by daily rubbing their bodies, Mr. Clark thinks, there are cases of disease in which it may prove hurtful in certain parts; as in swelling of the legs, attended with inflammation, where rubbing with the hands is frequently recommended; or when there is a discharge of sharp ichorous matter from the pores, or in cracks in the heels, attended with great pain, or in wounds or punctures. As all these are attended with more or less inflammation, friction then proves hurtful on these parts; for the heat there being already considerable, friction will add to it, and, of course, do mischief: besides, as the vessels, in such cases, are too full and distended with blood, the force that is applied in rubbing the legs renders these vessels liable to be ruptured.

In regard to the practice of washing horses with cold water, in order to clean them, by throwing whole pailfuls on their bodies when they are over-heated, immediately after posting, &c. which is commonly done on the post-roads, Mr. Clark speaks in a doubtful manner; though it is said that no bad consequences follow from it. "If they are well rubbed down immediately after such exercises, there is, he thinks, no need for washing them with cold water, and then rubbing them afterwards; as the latter operation is sufficient to clean them, without running any risk by washing them with cold water.

He thinks it probable, that the only thing which prevents immediate bad consequences following from this manner of treatment is, that such horses are very soon afterwards put to active exercise on the road, by which they are put into strong perspiration again; for not only our experience (the above instance only excepted), but the experience of past ages, have demonstrated the bad consequences that commonly follow the too sudden application of cold, whether it be water or air, to an animal body when over-heated. Hence, it should seem most prudent to avoid the washing of horses, when they are over-heated, with cold water, more especially in cold chilly weather, as it answers no good purpose, and certainly is not without danger. For the same reason, washing the dirt off horses' legs, belly, and thighs, with cold water, immediately after they have performed a stage and have been over-heated, should likewise be avoided till they are cool. If well rubbed afterwards, and thoroughly dried, it will be very proper; but this is very seldom put in practice."

The effects of combing and dressing neat-cattle, have been found highly beneficial in different trials in promoting the thriving of the animals; but the time which it takes up is probably too much for general practice.

DRILL, a small track or longitudinal opening in the form of a slight furrow made in tillage-lands for the purpose of receiving any kind of seeds. They are made at very different distances, according to the sort of crops that are to be grown, the nature of the soil, and the kind of culture which is to be afterwards practised.

Drilling, the act of putting different kinds of crops into the ground in the drill-method.

Drill-*Husbandry*, the practice of sowing or planting grain and other seeds or roots with a machine, in regular rows or drills, in place of scattering them promiscuously by the hand, by which means they are intended to be dropped at more equal distances, and lodged at more proper depths, than can be done in the latter way. The business of horse-hoeing is intimately connected with it, and for the most part forms part of the same system, which is, repeatedly ploughing the interstices while the crop is growing in the rows. See *Horse-Hoeing*.

The practice of cultivating grain in drills or rows, for the purpose of being enabled to destroy the weeds more readily, though frequently styled the *New Husbandry*, is probably a method of practice derived from the most remote periods, as various nations in the East, where it is well known that no change in their system of cultivation has taken place for many thousand years, both drill and set their corn of every description. But the management of arable lands by this mode of husbandry was first introduced into this country, and digested into a kind of system, by Jethro Tull, Esq. of Sharbone, in the county of Berks, about the year 1713, whence it has been frequently known by the name of the Tullean or Tull's husbandry.

The advantages of this mode of cultivation over that of the common broad-cast system are described by Mr. Amos, in his Treatise on Drill-Husbandry, as very numerous and important.

In the broad-cast husbandry, the land, he conceives, is often sown in bad tilth, with more than double the quantity of seed that is necessary; which is always scattered at random, and sometimes by very unskilful hands. In some places the seed falls too thick, in which case the plants have no room or strength to tillure, the stems will be few and weak, and the crop liable to be beaten down and spoiled by bad weather; in other places it falls too thin, in which case weeds will spring up instead of corn, so that the farmer will manure his soil and waste his labour for little profit: and the seed being but imperfectly covered by the harrow, a part of it is destroyed by vermin which follow the sower; another part is exposed on the surface of the ground to rain, drought, and frost, which, if they do not destroy, greatly injure it. When the seed is harrowed in, it is placed at unequal depths; the seeds consequently sprout at different times, and produce an unequal crop; an accident to which barley is particularly liable. And if the roots are buried too deep, the cheering and vivifying powers of the sun and air are so impeded in exerting their necessary influences, that the roots never arrive at perfection; which brings on a premature ripeness, and, instead of good corn, the farmer only gets a crop of straw and light corn. In the broad-cast method, the soil cannot, he thinks, be hoed nor stirred to give more nourishment to the plants; nor can even the weeds be destroyed, without much expense and injury to the growing crop.

The drill-husbandry, in his opinion, overcomes all those difficulties and disadvantages. The land is made finer by frequent ploughings and harrowings, and the seed being planted at proper and equal depths gives the farmer a full command over the seasons whether they are wet or dry, and secures an equal and clean crop in all circumstances of the weather. It saves more than one-third of the seed which is used in the broad-cast method; deposits it at equal depths, suited to the nature of each kind of seed; distributes it at equal distances; and, by being equally and speedily covered, it is protected from vermin and other injuries. It gives the husbandman an opportunity of horse and hand-hoeing his land, which almost totally destroys the weeds, without injuring the growing crop; and gives the roots of plants liberty to extend themselves in search of their necessary food, so that they have the full advantage of all the soil's fertility. By the frequent stirrings and hoeings, the plants tillure more; the rains, dews, &c. are more freely imbibed by the well pulverized soil; and the aliment which they contain is directly conveyed to the roots and fibres of the plants which grow upon it; by which means the land is so much fertilized, that it is half prepared for a succeeding crop. The intervals between the rows give due admission to a free circulation of air, which is absolutely necessary to promote a vigorous vegetation. In consequence of this freedom of air, upon which

he lays great stress, the ears of corn are always observed to be well fed, and the stalks firm and strong, and abler to stand against the storms of wind and rain. Hence, he says, it is evident, that the chief instrument which nature makes use of to fructify the earth, and furnish the pabulum of plants, is the atmosphere, which is the great fund or magazine of all the principles of vegetation; and it is from that great and inexhaustible source that the fertility of the earth is derived. But pulverization is, he thinks, absolutely necessary to prepare the soil for the reception of these particles; for earth, in its natural compact state, admits neither rain, dew, snow, nor any of those finer and more subtilized particles which are continually floating in the atmosphere, descend with them to the earth, and are carried off with them in the streams they form on the surface, together with such other particles as they take up and arrest in their way. In this respect nature is, he imagines, particularly assisted by the drill-husbandry, which breaks, divides, and pulverizes the soil, so as to prepare it for the easy entrance of those fertilizing principles with which the atmosphere abounds. Hence, he says, it is evident, that the advantages of the drill-husbandry are very great, and that it is far superior to the broad-cast method, whether it is considered as connected with the horse-hoe, or only for sowing the land in equidistant rows.

And it is remarked, by Mr. Exter, of Pilton, Devonshire, in a practical paper on drilling corn, contained in the ninth volume of the Letters and Papers of the Bath Agricultural Society, that it seems extraordinary, that a subject of so much importance to the farmer and the public, as the comparative modes of sowing corn by the *Old* or *New Husbandry* should have been so little attended to by men of abilities, and by gentlemen of landed property, whose interest is so much connected with it, as to have remained such a number of years undetermined, since it was first introduced by Mr. Tull; and that some more satisfactory and conclusive experiments have not been made, and published to the world, to determine the matter with greater precision. But so unsettled, says he, is this important point at this day, that we find some of the best practitioners in agriculture, not only in different soils and districts of country, but even on soils of the same nature, and within a few miles of each other, constantly disputing on the propriety of one or the other mode of practice; and this seems the more extraordinary to him, as his own experiments, which, he says, have been pretty extensive, and, he flatters himself, made not only with a critical, but, he will venture to assert, impartial attention, have uniformly, on every soil and situation, for six years successively, been decidedly in favour of the new system. In the year 1790, he says, he made his first trial of drill-husbandry, by sowing a small part of a field, with Winter's drill-machine, with barley at six inches, the intervals of which were hand-hoed. The productiveness of this piece of ground, under certain disadvantages of poverty of soil, unfavourable weather, &c. was sufficient to convince him of the advantages of the system under a better management, and excited his curiosity to make further comparisons between drilling and broad-cast sowing.—In order the better to answer his purpose, he made a journey in the summer of 1791 to see different crops then growing, which had been sown with drill-machines, and to collect what intelligence he could on the subject; the result of which was, his determining in favour of Mr. Cooke's machine, and his system of management. He therefore ordered a machine from Mr. Cooke, which he received in the autumn following; but, owing to its being detained by unfavourable winds on the sea, too late for his wheat-tillage, which was finished before he received it. However, as he had got the machine, he was anxious to make some trial of it; and having only one piece of ground at that time (November) in a possible state to admit of drilling, a very foul and poor pea-stubble, worth about 12*s.* per acre, he determined to begin with that, though the land was neither manured, nor in tilth for corn of any kind. The field, says he, consisted of two acres and a half of light, dry, loamy land, middling barley soil, and he drilled it at the rate of one bushel of red *Lammas* wheat per acre, in rows, with nine inches intervals. My servant-man, says he, an orthodox manager in the old husbandry of the country, and very averse to the drill system, both on account of the apparent complexity of the machine, and the idea of the great loss of land in the intervals between the rows of plants, was, says he, directed to fix on any part of the field which he considered as best in tilth and condition, to sow it broad-cast, and to manage it exactly as he should think proper. He confessed the part he chose was better by five or six shillings per acre than the average of the drilled land, and he sowed his part at the rate of two bushels per acre, the usual allowance of the country; and during the growth of the crop he paid unusual attention to the keeping it clean from weeds, &c. The drilled crop being thin sown, made but a poor appearance till June; the broad-cast, on the contrary, looked much more verdant and thriving during the winter and beginning of spring, till the end of May, at which time it became rather sickly and yellow. The drilled crop was scarified once in March, and horse-hoed in the last week of May; after this last operation it improved greatly, and began to show a decided superiority over the broad-cast, which evidently continued to decline. At harvest the drilled part yielded nineteen bushsels three pecks, nine-gallon measure, per acre; the part broad-cast not quite five bushels per acre.

In March 1792, he drilled one bushel of white *Lammas* wheat on one acre of potatoe-fallow, worth 20*s.* per acre, prepared by once ploughing and harrowing. The plants, when double-leaved, had one scarifying, and immediately after were harrowed across with the common harrow, and, when six or eight inches high, were horse-hoed; the crop appeared very thin till after Midsummer, yet he had a very great produce at harvest, both of grain and straw: the acre yielded twenty-nine bushels three pecks of wheat, nine-gallon measure. The same

spring he tilled thirty acres of land, worth from 35s. to 40s. per acre, with barley; fifteen acres drilled at two bushels per acre, with rows at nine inches; and fifteen acres broad-cast, from three to four bushels per acre; the preparation of the land, manuring, &c. in every respect alike. The season proved very wet, both during the growth of the crop and at harvest. The part broad-cast was lodged, stained, and with great difficulty harvested at all. The drilled corn stood better, scarcely any of it was lodged, and being free from grass and weeds was all saved without the least injury, at half the extra expense of the broad-cast; the produce of grain from ten to fifteen bushels per acre more, and a shilling per bushel better, and this notwithstanding the whole of the broad-cast crop had the advantage of being first sown; a circumstance which, that season, was particularly remarked by the neighbouring farmers to have been universally favourable to the crop; the early-sown barley having every where succeeded better than the late-sown. In October following he tilled a field of ten acres with wheat; the management of this field, with respect to tilling, manuring, &c. in every respect similar, except that one half was drilled with half the quantity of seed at nine-inch intervals, and that the other half was sown broad-cast. But as some doubts were advanced respecting the value of the land on different parts of the field, two twelve-furrow ridges, by way of proof, were gathered through the middle of the part intended to be drilled, and the drilling was begun on each side of those ridges. The ridges were ploughed, sown, and managed according to the common husbandry of the country, by the person before mentioned, and every attention paid to weeding them in the spring; the drilled crop was scarified and horse-hoed once. At harvest the two ridges were cut first, and immediately after a breadth of the broad-cast on each side of the ridges was cut, and each part stacked and kept separate till it was dry enough to thresh, when it was carted into two different barns, and immediately threshed and winnowed: the drilled crop yielded twenty-nine bushels three pecks, the broad-cast twenty bushels one peck. In order to guard against any supposition of fraud or imposition, the whole was winnowed and measured by the same man, the person who was so very averse to the drill-system, and conducted the experiment in favour of the broad-cast against me; whose honesty he could depend on, though so much prejudiced against the new mode of management.

The advantages gained in the above experiments by the drill-system gave him, he says, such a favourable idea of it, that he has ever since followed it for the whole of his crops, and has repeatedly sown a part broad-cast by way of proof; and has never once, among all his trials, seen the broad-cast sowing equal the drilled part. In all the experiments alluded to, he speaks of white-straw crops only, as he believes the greatest enemies to drilling admits its advantages in all crops of pulses; and he is certain it is equally superior to broad-cast for turnips. In the whole course of his attention to this system, he has, he says, endeavoured to steer as clear as possible from every prejudice that theory might suggest, and confined himself only to those positive facts that arose from absolute practice. He next briefly enumerates the advantages that appear to him to attend the drill-system, and states the disadvantages he has heard it charged with by other agriculturists.

The *advantages* of drill-husbandry he conceives to be these: 1st, Saving of half the seed-corn usually sown. 2d, A more regular and certain growth of that seed, from its being deposited at such depth in the soil that it immediately vegetates, and grows on more regularly together, and ripens at the same time —a matter of great importance in a dry spring sowing. 3d, Assisting the growth of the crop by pulverizing and breaking the soil, and destroying the infant weeds during the growth of the crop on it, by scarifying and horse-hoeing. 4th, Producing a larger and better crop; which is, 5th, Harvested at a less expense, and with a greater certainty, as it never abounds with grass, weeds, &c. as broad-cast corn often does, and is never injured by the luxuriant growth of artificial grasses in wet summers. 6th, The scarifying and horse-hoeing leave the soil in a much more friable state, and cause it to work much freer, and prove more productive for the future crops.

It is farther observed, that the field sown half broad-cast, and half with the drill-machine, in the year 1791, was all sown the following year with oats broad-cast; and that the part on which the corn was drilled the preceding year, and had produced a much larger crop of wheat, produced a much larger quantity of both straw and corn than the part of the field did on which the wheat had been sown by hand. The line of drilled part and broad-cast was, he says, as distinctly to be seen by the superiority of the crop of oats, as it was marked by that of the wheat the preceding summer; a circumstance by no means to be accounted for but by the effects of the operations of scarifying and horse-hoeing on the soil. It may be said, that a good fallow previous to sowing the crop may have the same effect. He is inclined to doubt it; but if it should, it will not, he says, be so cheap and concise a method, and a certain time must be lost in the preparation, to say nothing of the labour employed in it.

The *disadvantages* of drill-husbandry, which he has heard advanced by gentlemen who have unsuccessfully attempted it, are, according to his statement, the following: 1st, The difficulty of finding a person acquainted with the use of the machine. This, he remarks, though no objection to the system, will remain a difficulty before it becomes more general, but is a circumstance attending every new practice. 2d, The soil must be very well prepared to admit of it: not, he thinks, at all finer than for good management in the broad-cast. 3d, The crop is too thin sown, and land lost in the intervals. This objection, he believes, has some force on certain soils, if the scarificator and hoe be not used, but is entirely done away if it be well managed. 4th, Harvesting later than broad-cast crops. This, he contends, might be brought in argument against a dunghill, though few modern farmers will reject its

use on that account. 5th, Clover not succeeding with it. His crops of clover speak, he says, powerfully in favour of it; he has never had better in the common way. 6th, Oats producing straw rank and coarse, and not good food for cattle. If oxen are admitted as evidence, he is sure they will prove the contrary: his have been alternately fed with drilled straw and broad-cast for months together, and no difference was perceptible in their thriving on one or the other.

On the whole, it appears to him, from the experience he has had, that the first and greatest objection to this system is the difficulty of procuring a person who is acquainted with the use of the machine, and the after-management of the crop during its vegetating process. He is persuaded, if he had not gone through every part of the business himself, that his drilling would have been a work of a season only; by entering himself into the minutiæ of it, and by doing the whole business, he found the difficulty of sowing soon done away; and he thinks he could undertake to make any young man a complete drillman in one half the time he could be taught to manage a common plough: attention and practice, with a small degree of instruction, are the only requisites to complete him in either. With respect to the scarifying and hoeing, necessarily connected with it, much, he says, remains at present to be learned, and he is not satisfied that the precise time of first scarifying is yet scientifically determined on. From the experience of this year he is induced to think it should not be done too early, on very light and dry soils, perhaps not till the coronal root of the plant is completely formed, as it was found this season to expose the corn more to the ravages of the wire-worm; but on strong soils, this objection has no weight, and it may be begun as soon as they are dry enough to admit of the horse going over them without poaching.

He here thinks it necessary to remark, that he supposes these operations of scarifying and hoeing have been too often neglected altogether, to the very great injury of the system; many gentlemen who have drilled have looked no farther into the business. The first operation of scarifying in the spring should, he conceives, but just move the surface; the instrument should not be forced deep into the soil, particularly in light lands worked early. The repetition of this operation is not so very nice a matter; when the plants are vigorous, and about six or seven inches high, the intervals may be worked to a considerable depth. He has himself seen instances of the above inattention, and is convinced how severely the system has been injured by it. He must here again repeat, he says, for it cannot be too rigidly insisted on, that on these operations being well followed up, the whole advantage will depend; and this leads him to observe, that on those soils where this cannot be done, perhaps drilling may be altogether improper. A question then, says he, naturally arises: On what soils is drilling practicable with advantage, and on what is it improper? He conceives it practicable on all soils that are not very stony or rocky, or so very *declivous* that the machine or scarifier cannot be worked with two horses with facility. It has been said by some gentlemen who have tried on heavy clay soils, that these are unfavourable to its use, that the coulters do not deposit the seed deep enough in the soil. In the heaviest soils he has tried, it produced him the finest crops. He has never occupied any very obdurate clayey soils, but on those strongest loamy soils which he has drilled he has produced the best crops, and comparatively more productive than on the lighter ones; and is therefore inclined to believe, that few soils are to be objected to as unfavourable to the system on account of their stiffness merely. To say these soils will only work in a certain degree of moisture and temperament, and therefore will not admit of drilling, is, he thinks, saying nothing but what may be said against ploughing or harrowing, &c.—Whenever the soil is in a condition to admit of harrowing or dragging, it may be drilled with propriety.

Having, says he, for several years past been in the habit of instructing pupils in the theory and practice of agriculture, I have made a point of recommending to them the use of the drill-machine, on a different principle than either saving seed or producing a greater crop, or any advantage already mentioned: for he will venture to assert, that a young practitioner in husbandry will gain more knowledge in the business of aration, and the advantages of a well-managed fallow, by drilling his crops one season, than by three years attention, assisted by good instructions, without it. Bad ploughing, bad harrowing, couch, clods, and every thing that a good farmer knows he ought to avoid or correct, are detected by it. The test of good or bad management in every part of his field is immediately under his own hand; he cannot pass a single foot of land in bad tilth without instantly perceiving it; and he believes it will be readily allowed by every good practitioner, that whatever will obstruct the drill would annoy the crop to be sown; or, in other words, the completer the pulverization of the soil, in general, the more luxuriant will be the produce.

Among the advantages of drilling has been marked, he says, that of stirring the soil during the growth of the crop; and this advantage does not seem to depend merely on the pulverization of the soil, but may be accounted for by its being kept open at that time, and in a condition to absorb some matter from the atmosphere, calculated to assist vegetation on the present, as well as future crops; this appears clearly from the effect produced on the broad-cast oats before mentioned; and the following observation on a potatoe-crop will, he says, likewise support the opinion: A foul piece of poor land was planted with potatoes in two different ways; the one part in the common lazy-bed method, the other part in drills of two rows at a foot asunder, and three feet intervals left between to be worked with the common plough, which interval was three times ploughed, and once hand-hoed, during the growth of the crop. A part of the same field, between two crops of potatoes, was dunged in the same proportion as the potatoe-ground, and kept clean by three summer ploughings, and several harrowings. The drilled potatoes were by

far the best crop, though planted with only two-thirds the quantity of seed. The next year the same field was sown with barley. The drilled potatoe part produced by much the best and cleanest crop; the next best crop was on that part which bore the potatoes in the common mode of management; and the summer-fallowed part, which bore no crop the preceding year, was, contrary to every body's expectation, the worst of the whole. This experiment then, says he, proves, that simply pulverizing the soil mechanically, and manuring, will not equal the advantage of a horse-hoed crop, and speaks, he conceives, very much against summer-fallowing on light soils.

In December 1796, a few days after he had attended the general meeting of the Bath Agricultural Society, where he heard the subject of drill-husbandry very slightly spoken of, he went, he says, into Gloucestershire, on a visit to a gentleman of his acquaintance near Wotten-Underedge, and walking with him through a wheat-stubble, he observed it had been irregularly drilled at one foot asunder, and which he told him had been done by his labourer and his family. The labourer, by his desire, was sent for, and informed him it had been the common practice of the neighbourhood ever since he could remember; and he had heard his father make the same remark, and from what he could trace, it must have been upwards of eighty years. He described the method as follows: The fallow being prepared (this was a clover-stubble once ploughed, dragged, and harrowed), shallow furrows were opened at a foot asunder with the common plough, and in these the seed was sown by women and children from phial-bottles, and after sowing, the lands were harrowed lengthways. Quantity of seed one bushel per acre, expense of drilling 6*s.* The space between each row was dug with a hoe, or small mattock, in the next spring, in order to destroy weeds, &c. The man very gravely asserted, he says, that no clean wheat could be got in their neighbourhood by any other mode, the soil being so very subject to weeds. Here then, says the writer, is a strong proof of the drill-system prevailing under heavy expenses, and an awkward mode of management, long enough to establish its reputation with the common labourer. The crops produced by this mode were fine, and the grain good.

It was, he says, his intention this season (1797), for the satisfaction of the society, to have made some further comparative trials on spring-corn; but having determined, for the first time, on drilling his clover between the rows of corn, he was a little embarrassed on that account, and his comparative crop was confined to a single field of very high poor ground, value 10*s.* per acre, its exposure due north, and perfectly open to the stormy north-western gales, which, he says, are very violent in North-Devon. This field had borne a crop of drilled wheat, about sixteen bushels per acre, the last season, for which crop it had been prepared in the usual manner, by paring, burning, and a manuring of lime. Half this field was sown with barley, the other half, which was very *declivous* to the north, sown with oats; nearly half the barley-ground was drilled, partly at nine inches, partly at twelve inches distance; the oats all sown broad-cast, except three-fourths of an acre, which was drilled with one bushel and two pecks of white oats at one foot asunder. At harvest the drilled was evidently the cleanest, heaviest, and best crop; but a very heavy gale of wind arose a few days before it was to be cut, which shed a great quantity of the grain; and as the drilled corn was longer eared, and the straw longer, it suffered more than the broad-cast, which was very short and small eared. Sixteen perches of the barley drilled at a foot, and the same quantity of the broad-cast barley, were immediately bound after the scythe, and wind-rowed, and, as soon as dry, carted into two separate barns and threshed. The same was intended to have been done with a certain proportion of the broad-cast oats, but the very unfavourable weather at harvest prevented him from attending to it, and his people hurried away the broad-cast oats adjoining to the drilled part without his knowledge; but the extra produce of straw and oats sufficiently convinced him of its superiority, being fully double any crop of oats he ever had on the same land. The following was the proportion of the barley: the drilled eleven pecks, broad-cast nine pecks and three-fourths, or, per acre, drilled twenty-seven bushels two pecks, broad-cast twenty-four bushels one peck; to which add the saving of two bushels of seed per acre, makes five bushels one peck of barley, which at the last year's price of 4*s.* was just 1*l.* 1*s.* per acre in favour of drilling—more than double the rental value of the land on which it grew. The 120 perches of oats, drilled with one bushel and two pecks of seed, yielded just forty bushels, nine-gallon measuse, or, per acre, fifty-three bushels and one-third, besides a large proportion of corn shed, calculated by every body who saw it to be eight bushels, and eighty-five bundles of straw, 40*lb.* each, somewhat more than a ton and a half. He never yet had more than thirty bushels, nor two-thirds the weight of straw, on any broad-cast acre of oats on the same land. The balance in favour of drilling the barley-crop on the field above mentioned was by far the smallest of all the comparative trials he has made, which is accounted for, he thinks, by its being on the poorest soil he ever drilled with that grain; for he is of opinion, if the crop does not lodge, which seldom happens to drilled crops, that the balance will ever be greatest, particularly at the great distance of a foot between the rows of corn, on the richest soils in the best state of cultivation.

He has, he says, this season several crops of turnips, partly drilled and partly broad-cast, in the same field; the advantage of drilling is too apparent to admit a doubt on it; and there is a saving of at least 4*s.* per acre in the hoeing of a crop drilled at twelve inches apart, besides the opportunity of doing the work more completely. Beans drilled in two rows at nine inches, with an interval of twenty-seven, if weeded early, and ploughed between as directed by Mr. Cooke, become quite a thicket. His crop of this year exceeded any thing he ever saw; and Mr. White Parsons, of Queen-Camel,

who lives in a bean-country, he says, assured him he never saw so fine a crop. The fallow is in complete order for wheat. It happened, he thinks fortunately, that a certain portion of this field, from the accelerated growth of the beans from the wet weather in May and June, could not be ploughed a second time between the rows, and it is now astonishing to see the difference in the friability of the fallow; the part twice ploughed between the rows works better on a single ploughing and harrowing than the part not ploughed between would work with three ploughings, &c. The one a fine mellow loam, the other a clay—another strong proof of the advantages of ploughing between drill-crops while growing. He concludes by observing, that he could produce a much longer list of proofs in favour of this system, but as they nearly correspond with those already mentioned, he considers them as unnecessary. He trusts those already given will, to unprejudiced minds, carry the conviction that, on certain soils at least, the principle is right, and the practice eligible; and, in evidence of it, he brings forward the frank acknowledgment of Mr. Arthur Young, who last year did him the honour to pay very minute attention to his crops, and declared he had seen none, in a journey of 300 miles, that exceeded them, on any soil; and that, from their appearance, he was persuaded, in the hands of a man of attention, the drill system would generally exceed the broad-cast.

The following comparative experiments, detailed by Mr. Amos, in his Treatise on Drill-Husbandry, set the advantages of the drill above the broad-cast method in so clear a point of view, he thinks, that he that runs may read. In the year 1783, he began the experiments upon various kinds of soil, and in every one of them employed two acres of land, laid up in eleven-feet ridges, and drilled and sown broadcast alternately.

"*Experiments on Oats—The Soil a hazel-coloured stiff Loam, worth 20s. per Acre.*

1783.	*Drilled Acre* Dr.	£.	s.	d.
Mar. 6.	To ploughing it from swarth	0	5	0
10.	To 5 harrow^gs & 1 rolling, at 6*d*.	0	3	0
	To drilling the seed 2 inches deep and 8 asunder -	0	0	6
	To harrowing after - -	0	0	6
	To 12 pecks of seed at 9*d*. -	0	9	0
April 20.	To rolling - -	0	0	6
May 14.	To breast-hoeing 1st time -	0	2	0
June 5.	To ditto 2d time - -	0	2	0
	To hand-hoeing - -	0	1	6
	To 1 year's rent, &c. -	1	1	0
		2	5	0
	Contra Cr.			
Sept. 19.	By produce of the crop, 56 bushels, at 2*s*. 3*d*. per bushel -	6	6	0
	Clear profit	4	1	0

1783.	*Broad-cast Acre* Dr.	£.	s.	d.
Mar. 6.	To ploughing up from swarth	0	5	0
10.	To 8 harrowings, at 6*d*.	0	4	0
	To seed for 16 pecks, at 9*d*.	0	12	0
	To sowing ditto -	0	0	3
April 20.	To rolling - -	0	0	6
May 24.	To hand-weeding 1st time	0	2	6
June 15.	To hand-ditto 2d time -	0	3	0
	To rent, &c. -	1	1	0
		2	8	3
	Contra Cr.			
Sept. 19.	By produce for 50 bushels, at 2*s*. 2½*d*. - -	5	6	3
	Clear profit	2	18	0
	By gain in favour of the drilled crop - -	1	3	0
		4	1	0

"*Experiments on Cole Seed—after the Oats.*

1783.	*Drilled Acre* Dr.	£.	s.	d.
Nov. 4.	To ploughing the lands across,			
1784.	5 inches deep -	0	5	0
Mar. 1.	To break-harrowing 1st time	0	1	6
26.	To ploughing the 2d time	0	5	0
April 24.	To break-harrowing 2d time	0	1	0
	To harrowing and rolling -	0	1	0
May 16.	To ploughing the land 3d time	0	4	0
30.	To 4 chalders of lime, at 10*s*. (half charged) -	1	0	0
	To drag-harrowing -	0	1	6
June 12.	To rolling and harrowing	0	1	0
28.	To ploughing 4th time -	0	4	0
	To harrowing & rolling do. twice	0	2	0
29.	To drilling every other land, 1 inch deep, 12 asunder	0	0	6
	To seed for one-fourth of a peck	0	0	6
	To harrowing ditto -	0	0	6
July 24.	To hoeing 1st time (breast-hoe)	0	2	6
Aug. 16.	To hoeing 2d time ditto	0	2	0
	To a year's rent, &c. -	1	1	0
	Expenses	3	13	0
	Contra Cr.			
Nov. 24.	By value of crop appraised	4	0	0
	Clear profit	0	7	0

	Broad-cast Acre Dr.	£.	s.	d.
1784.				
	To 4 ploughings -	0	18	0
	To 6 harrowings -	0	3	0
	To 2 rollings -	0	1	0
	To 4 chalders of lime (half charged) - -	1	0	0
June 28.	To sowing every other land	0	0	3
	To seed, for one-fourth of a peck	0	0	3
	To harrowing ditto -	0	0	6
	To rolling - -	0	0	6
July 10.	To harrowing the crop -	0	0	6
18.	To hoeing the 1st time -	0	3	0
Aug. 12.	To hoeing 2d time -	0	2	6
	To 1 year's rent, &c. -	1	1	0
	Expenses	3	10	6
	Contra Cr.			
Nov. 24.	By value of the crop appraised	3	16	0
	Clear profit	0	5	6
	By gain in favour of the drilled crop - -	0	1	6

"*Experiments on Barley—after the Cole Seed.*

1784.	*Drilled Acre* Dr.	£.	s.	d.
Dec. 24.	To ploughing the land 1st time	0	5	0
1785.	To half the charge of the lime	0	18	0
Mar. 20.	To break-harrowing the land	0	1	0
April. 1.	To ploughing the land 2d time	0	4	0
	To harrowing ditto 3 times, and rolling	0	2	0
	To drilling the seed 2 inches by 9 inches	0	0	6
	To harrowing ditto	0	0	6
	To seed for 8 pecks at 9*d.*	0	6	0
	To rolling	0	0	6
May 10.	To breast-hoeing the 1st time	0	2	0
	To hand-weeding the rows	0	1	0
June 4.	To breast-hoeing the 2d time	0	1	6
	To hand-weeding the rows	0	1	0
	To 1 year's rent, &c.	1	1	0
	Expenses	3	4	0
	Contra Cr.			
Aug. 20.	The whole was reaped, and in a few days was housed, threshed, and produced 58 bushels at 3*s*	8	14	0
	Clear profit	5	10	0

1784.	*Broad-cast Acre* Dr.	£.	s.	d.
Dec. 24.	To ploughing the 1st time	0	5	9
1785.	To half the charge of the lime	0	18	0
Mar. 20.	To break-harrowing the land	0	1	0
April 1.	To ploughing the land 2d time	0	4	0
	To sowing the seed	0	0	3
	To seed for 12 pecks at 9*d.*	0	12	0
	To harrowing ditto 4 times	0	2	0
	To rolling ditto	0	0	6
May 10.	To hand-hoeing the 1st time	0	2	6
June 4.	To hand-weeding the 2d time	0	2	0
	To rent, &c. for 1 year	1	1	0
	Expenses	3	8	3
	Contra Cr.			
Aug. 26.	The whole was reaped, and in a few days was housed, threshed, and produced 51 bushels at 3*s.*	7	13	0
	Clear profit	4	4	9
	By gain in favour of the drilled crop	1	5	3
		5	10	0

"*Experiments on Beans—after the Barley.*

1785.	*Drilled Acre* Dr.	£.	s.	d.
Nov. 4.	To ploughing the land 1st time	0	5	0
1786.				
Mar. 6.	To break-harrowing	0	1	0
8.	To ploughing 2d time	0	4	0
	To 4 harrowings at 6*d.*	0	2	0
	To rolling	0	0	6
	To drilling the seed 3 by 24 inches	0	0	6
	To harrowing ditto	0	0	6
	To seed for 8 pecks at 10½*d.*	0	7	0
April 20.	To rolling	0	0	6
	To harrowing	0	0	6
May 16.	To horse-hoeing 1st time	0	1	0
20.	To hand-hoeing the rows	0	1	6
June 16.	To horse-hoeing the intervals 2d time	0	1	0
18.	To hand-hoeing the rows	0	1	6
26.	To earthing up ditto 1st time	0	1	0
July 10.	To earthing up ditto 2d time	0	1	0
	To rent, &c.	1	1	0
	Expenses	2	9	6
	Contra Cr.			
Sept. 29.	By produce for 36 bushels at 3*s.* 6*d.*	6	6	0
	Clear profit	3	16	6

1785.	*Broad-cast Acre* Dr.	£.	s.	d.
Nov. 4.	To ploughing the 1st time	0	5	0
1786.				
Mar. 4.	To break-harrowing	0	1	0
8.	To ploughing the 2d time	0	4	0
	To sowing the seed	0	0	3
	To harrowing ditto 5 times	0	2	6
	To seed for 12 pecks at 10½*d.*	0	10	6
April 20.	To rolling and harrowing	0	1	0
May 29.	To hand-weeding 1st time	0	3	0
June 30.	To ditto 2d time	0	1	6
	To rent, &c.	1	1	0
	Expenses	2	9	9
	Contra Cr.			
Sept. 29.	By produce for 30 bushels at 3*s.* 6*d.*	5	5	0
	Clear profit	2	15	3
	By gain in favour of the drilled acre	1	1	3
		3	16	6

"*Experiments on Wheat—after the Beans.*

1786.	*Drilled Acre* *Dr.*	£.	s.	d.
Sept. 18.	To ploughing land 1st time	0	5	0
Oct. 6.	To break-harrowing ditto	0	1	0
	To gathering the weeds off	0	2	0
8.	To ploughing the land 2d time	0	4	0
	To harrowing ditto thrice and 1 rolling	0	2	0
	To drilling every other land $\frac{1}{3}$ by $\frac{1}{8}$	0	0	6
	To seed for 7 pecks at 16*d.* per peck	0	9	4
1787.	To harrowing ditto	0	0	6
April 20.	To rolling and harrowing for 1st weeding	0	1	0
May 6.	To hoeing intervals 1st time	0	2	0
	To hand-weeding the rows	0	1	0
30.	To hoeing 2d time	0	1	6
June 4.	To hand-weeding the rows	0	1	0
	To 1 year's rent, &c.	1	1	0
	Expenses	2	11	10
	Contra *Cr.*			
Aug. 24.	By produce for 36 bushels at 5*s.* 6*d.*	9	18	0
	Clear profit	7	6	2

1786.	*Broad-cast Acre* *Dr.*	£.	s.	d.
Sept. 28.	To ploughing 1st time	0	5	0
Oct. 6.	To break-harrowing	0	1	0
	To gathering the weeds off	0	2	0
8.	To ploughing 2d time	0	4	0
	To seed for 9 pecks 1*s.* 4*d.*	0	12	0
	To sowing ditto	0	0	3
1787.	To harrowing 5 times	0	2	6
April 20.	To rolling and harrowing 1st weeding	0	1	0
May 14.	To hand-weeding 1st time	0	2	6
June 12.	To hand-weeding 2d time	0	2	0
	To 1 year's rent, &c.	1	1	0
	Expenses	2	13	3
	Contra *Cr.*			
Aug. 26.	By produce for 30 bushels at 5*s.* 6*d.*	8	5	0
	Clear profit	5	11	9
	By gain in favour of drilled crop	1	14	5
		7	6	2

"*Experiments on Turnips—the Soil a light sandy Loam, worth about Eighteen Shillings per Acre.*

1789.	*Drilled Acre* *Dr.*	£.	s.	d.
Feb. 11.	To ploughing the 1st time	0	5	0
31.	To break-harrowing	0	1	0
April 28.	To ploughing the 2d time	0	4	6
May 10.	To harrowing twice	0	1	0
	To gathering the couch-grass off	0	2	6
24.	To 10 loads of rotten dung (charged half)	0	12	6
	To ploughing the 3d time	0	4	0
	To rolling	0	0	6
June 16.	To harrowing twice	0	1	0
	To rolling	0	0	6
18.	To ploughing the 4th time	0	4	0
	To harrowing thrice	0	1	6
	To rolling	0	0	6
	To drilling the seed 1 inch by 12	0	0	6
	To harrowing ditto	0	0	6
	To seed for 1lb. of sugar-loaves	0	0	6
July 20.	To harrowing 1st weeding	0	0	6
28.	To breast-hoeing 2d ditto	0	2	0
Aug. 28.	To hand ditto 3d. ditto	0	2	6
	To 1 year's rent, &c.	0	19	0
	Expenses	3	4	0
	Contra *Cr.*			
Dec. 10.	By the value of the crop appraised	3	15	6
	Clear profit	0	11	6

1789.	*Broad-cast Acre* *Dr.*	£.	s.	d.
Mar. 1.	To ploughing 1st time	0	5	0
31.	To break-harrowing	0	1	0
April. 28.	To ploughing 2d time	0	4	6
May 10.	To harrowing twice	0	1	0
	To gathering the couch-grass	0	2	6
24.	To 10 loads of dung (charged half)	0	12	6
	To ploughing in ditto	0	4	0
	To rolling	0	0	6
June 16.	To harrowing and rolling	0	1	0
18.	To ploughing 4th time	0	4	0
	To 3 harrowings and 1 rolling	0	2	0
	To seed for 1lb. of sugar-loaves	0	0	6
	To sowing ditto	0	0	3
	To harrowing and rolling ditto	0	1	0
July 20.	To harrowing for the first weeding	0	0	6
28.	To hand-hoeing 1st time	0	3	6
Aug. 18.	To ditto 2d time	0	2	6
	To 1 year's rent, &c.	0	19	0
	Expenses	3	5	3
	Contra *Cr.*			
Dec. 12.	By the value of the crop appraised	3	8	0
	Clear profit	0	2	9
	By gain in favour of the drilled crop	0	8	9
		0	11	6

"*Experiments on Barley—after the Turnips.*

1789.	*Drilled Acre.* Dr.	£.	s.	d.
	To half the charge of the dung	0	12	6
Dec. 20.	To ploughing 1st time	0	5	0
1790. Mar. 24.	To break-harrowing	0	1	0
April. 10.	To ploughing 2d time	0	4	0
	To harrowing thrice	0	1	6
	To rolling	0	0	6
	To drilling the seed 2 inches by 9	0	0	6
	To harrowing and rolling ditto	0	1	0
	To seed for 8 pecks at 10*d.*	0	6	8
May 6.	To hoeing the 1st time	0	2	0
	To hand-weeding the rows	0	1	0
June 16.	To hoeing 2d time	0	1	6
	To hand-weeding the rows	0	1	0
	To 1 year's rent, &c.	0	19	0
	Expenses	2	17	2
	Contra Cr.			
Aug. 26.	By produce for 52 bushels 3*s.* 6*d.*	9	1	0
	Clear profit	6	3	10

1789.	*Broad-cast Acre* Dr.	£.	s.	d.
	To half the charge of the dung	0	12	0
Nov. 20.	To ploughing 1st time	0	4	6
1790. Mar. 24.	To break-harrowing	0	1	0
April 10.	To ploughing 2d time	0	4	0
	To seed for 12 pecks at 10*d.*	0	10	0
	To sowing ditto	0	0	6
	To harrowing ditto 4 times	0	2	0
	To rolling ditto	0	0	6
May 20.	To weeding the 1st time	0	3	0
June 16.	To weeding ditto 2d time	0	2	0
	To one year's rent, &c.	0	19	0
	Expenses	2	18	6
	Contra Cr.			
	By produce for 47 bushels 3*s.* 6*d.*	8	4	6
	Clear profit	5	6	0
Aug. 26.	By produce in favour of the drilled crop	0	17	10
		6	3	10

"*Experiments on Red Clover—after the Barley.*

1791.	*Drilled Acre* Dr.	£.	s.	d.
	To seed for 1 stone in 1790	0	7	0
Mar. 29.	To bush-harrowing	0	1	0
	To raking and gathering the weeds off	0	3	6
	To rolling	0	0	6
June. 30.	To mowing 1st crop	0	2	6
	To making into hay	0	2	6
	To carting, &c. the crop home	0	15	0
	To mowing the 2d crop	0	2	6
	To making ditto	0	3	0
	To leading, &c. ditto home	0	10	0
	To 1 year's rent, &c.	0	19	0
	Expenses	3	6	6
	Contra Cr.			
	By the 1st eddish	0	4	0
	By the 1st crop 2 tons at 3 pounds	6	0	0
	By the 2 ditto—$1\frac{1}{2}$ ditto—ditto	4	10	0
	By the 2d eddish	0	5	0
		10	19	0
	Deduct expenses	3	6	6
	Clear profit	7	12	6

1791.	*Broad-cast Acre* Dr.	£.	s.	d.
	To 1 stone of seed in 1790	0	7	0
May 30.	To bush-harrowing	0	1	0
	To raking and gathering the weeds	0	3	0
	To rolling	0	0	6
	To mowing the 1st crop	0	2	6
	To making it into hay	0	2	6
	To leading ditto home	0	12	0
	To mowing the 2d crop	0	2	0
	To making ditto	0	2	6
	To leading ditto home	0	9	0
	To 1 year's rent, &c.	0	19	0
	Expenses	3	1	0
	Contra Cr.			
	By the 1st and 2d eddishes	0	8	0
	By the 1st and 2d crop $3\frac{1}{4}$ tons	9	15	0
		10	3	0
	Deduct expenses	3	1	0
	Clear profit	7	2	0
	By gain in favour of the drilled acre	0	10	6
		7	12	6

"*Experiments on Wheat—after the Red Clover.*

1791.	*Drilled Acre* Dr.	£.	s.	d.
Oct. 4.	To ploughing the land	0	5	0
	To 5 harrowings and 1 rolling - -	0	3	0
	To drilling the seed $2\frac{1}{2}$ inches by 9 - -	0	0	6
	To harrowing ditto -	0	0	6
1792.	To seed for 8 pecks, at 1*s.* 6*d.*	0	12	0
April 16.	To harrowing and rolling 1st weeding - -	0	1	0
May. 1.	To hoeing the 1st time -	0	2	0
12.	To hand-weeding the rows	0	1	6
20.	To hoeing 2d time -	0	1	6
24.	To hand-weeding the rows -	0	1	0
	To 1 year's rent, &c. -	0	19	0
	Expenses	2	7	0
	Contra Cr.			
Aug. 30.	By produce for 42 bushels, at 5*s.* - -	10	10	0
	By sheep-feeding, April 15.	0	3	6
	Clear profit	8	6	6

1791.	*Broad-cast Acre* Dr.	£.	s.	d.
Oct. 4.	To ploughing - -	0	5	0
	To seed for 9 pecks, at 1*s.* 6*d.*	0	13	6
	To sowing ditto - -	0	0	3
1792.	To harrowing 6 times -	0	3	0
April 16.	To ditto and rolling -	0	1	0
May 12.	To weeding the 1st time -	0	3	0
26.	To ditto the 2d ditto -	0	2	0
	To 1 year's rent, &c. -	0	19	0
	Expenses	2	6	9
	Contra Cr.			
	By sheep-feeding, April 15.	0	3	6
Aug. 30.	By produce for 36 bushels, 5*s.* - -	9	0	0
	Clear profit	5	16	9
	By gain in favour of the drilled acre - -	1	9	9
		8	6	6

"*Experiments on Potatoes—the Soil a light sandy Loam worth* 20*s. per Acre.*

1789.	*Horse-hoed Acre* Dr.	£.	s.	d.
Feb. 2.	To ploughing the 1st time -	0	5	0
28.	To harrowing - -	0	0	6
	To 12 loads of dung, 2*s.* $6\frac{1}{2}$*d.*	0	15	0
	To spreading ditto -	0	1	0
Mar. 1.	To ploughing the 2d time -	0	4	0
April 2.	To harrowing the 2d ditto -	0	0	6
24.	To ploughing with 3 ploughs	0	4	0
	To planting with 12 hands 3 inches deep, 9 inches asunder, and 30 inch. alleys	0	4	0
	To seed, 30 bushels, cutting, &c. 1*s.* 4*d.* - -	2	0	0
	To rolling - -	0	0	6
June 1.	To harrowing for 1st hoeing	0	0	6
10.	To skim-hoeing 1st time -	0	1	0
	To hand-hoeing the rows -	0	3	0
26.	To skim-hoeing 2d time -	0	1	0
	To hand-hoeing the rows -	0	3	6
July 1.	To earthing up the rows -	0	1	0
15.	To ditto - -	0	1	0
Aug. 2.	To picking the weeds out -	0	1	6
Oct. 20.	To taking up, pying, &c.	1	16	0
	Expenses	6	3	0
	Contra Cr.			
	By produce for 500 bushels at 8*d.* - -	16	13	4
	Clear profit	10	10	4

1789.	*Hand-hoed Acre* Dr.	£.	s.	d.
Jan. 12.	To ploughing 1st time -	0	5	0
Feb. 24.	To drag-harrowing -	0	1	0
	To 12 loads of dung at 2*s.* 6*d.* (charged half) - -	0	15	0
	To spreading - -	0	1	0
Mar. 1.	To ploughing 2d time -	0	4	0
30.	To harrowing twice -	0	1	0
April 24.	To ploughing with 3 ploughs	0	4	0
	To planting with 12 hands 3 inches deep, 8 inches asunder, and 24 inch. alleys	0	4	6
	To seed, 36 bush. cutting, 1*s.* 4*d.*	2	8	0
June 1.	To harrowing for 1st hoeing	0	0	6
14.	To hand-hoeing 1st time -	0	5	0
26.	To ditto 2d time -	0	4	0
July 6.	To earthing-up -	0	15	0
Aug. 3.	To picking the weeds out -	0	1	6
	To taking up, leading, pying, &c. - -	1	14	0
	Expenses	7	3	6
	Contra Cr.			
Oct. 24.	By produce for 420 bushels, at 8*d.* - -	14	0	0
	Clear profit	6	16	6
	By gain in favour of the horse-hoed acre - -	3	13	10
		10	10	4

"*Experiments on Barley—after the Potatoes.*

1790.	*Drilled Acre* Dr.	£.	s.	d.
	To half the charge of the dung -	0	15	0
Jan. 18.	To ploughing 1st time	0	5	0
Mar. 9.	To break-harrowing	0	1	0
April 10.	To ploughing 2d time	0	4	0
	To 3 harrowings	0	1	6
	To rolling -	0	0	6
	To drilling the seed 2 by 9 inches -	0	0	6
	To harrowing and rolling ditto -	0	1	0
	To seed for 7 pecks, at 11*d.*	0	6	5
May 14.	To hoeing the 1st time	0	2	0
	To hand-weeding the rows	0	1	0
June 6.	To hoeing the 2d time	0	2	0
	To hand-weeding the rows	0	0	6
	To 1 year's rent, &c.	1	1	0
	Expenses	3	1	5
	Contra Cr.			
Sept. 4.	By produce for 46 bushels, at 4*s.* 6*d.* -	9	16	8
	Clear profit	6	15	3

1790.	*Broad-cast Acre* Dr.	£.	s.	d.
	To half the charge of the dung -	0	15	0
Jan. 18.	To ploughing 1st time	0	5	0
Mar. 9.	To break-harrowing	0	1	0
April. 10.	To ploughing the 2d time	0	4	0
	To seed for 12 pecks, at 10*d.*	0	10	0
	To sowing ditto -	0	0	3
	To harrowing ditto 4 times	0	2	0
	To rolling -	0	0	6
May 14.	To weeding 1st time	0	4	0
June 4.	To ditto 2d time	0	1	6
	To 1 year's rent, &c.	1	1	0
	Expenses	3	4	3
	Contra Cr.			
Sept. 6.	By produce for 49 bushels, at 3*s.* 4*d.* -	8	3	4
	Clear profit	4	19	1
	By gain in favour of the drilled acre -	1	16	2
		6	15	3

"*Experiments on Red Clover—after the Barley.*

1791.	*Drilled Acre* Dr.	£.	s.	d.
	To seed for 1 stone sown in 1790 -	0	7	0
Mar. 30.	To bush-harrowing	0	1	6
	To raking and gathering the weeds -	0	2	6
	To rolling -	0	0	6
July 4.	To mowing 1st crop	0	2	6
	To making -	0	2	6
	To carting home, &c.	0	12	0
	To mowing 2d crop	0	2	0
	To making ditto	0	2	6
	To carting ditto home, &c.	0	9	0
	To 1 year's rent, &c.	1	1	0
	Expenses	3	3	0
	Contra Cr.			
	By the 1st eddish	0	4	0
	By produce 3 tons at 3*l.*	9	0	0
	By the 2d eddish	0	6	0
		9	10	0
	Deduct expenses	3	3	0
	Clear profit	6	7	0

1791.	*Broad-cast Acre* Dr.	£.	s.	d.
	To 1 stone of seed in 1790	0	7	0
Mar. 30.	To bush-harrowing	0	1	6
	To raking and gathering the weeds -	0	2	6
	To rolling -	0	0	6
June 20.	To mowing the 1st crop	0	2	6
	To making it -	0	2	6
	To leading ditto home	0	10	6
	To mowing the 2d crop	0	2	0
	To making ditto	9	3	0
	To leading ditto home	0	7	6
	To 1 year's rent, &c.	1	1	0
	Expenses	3	0	6
	Contra Cr.			
	By the 1st eddish	0	4	0
	By produce $2\frac{1}{4}$ tons at 3*l.*	8	5	0
	By the 2d eddish	0	5	0
		8	14	0
	Deduct expenses	3	0	6
	Clear profit	5	13	6
	By gain in favour of the drilled crop -	0	13	6
		6	7	0

"*Experiments on Wheat—after the Red Clover.*

1791.	*Drilled Acre* Dr.	£.	s.	d.
Oct. 1.	To ploughing the land -	0	5	0
	To 4 harrowings and 1 rolling -	0	2	6
	To drilling the seed $2\frac{1}{2}$ by 9 inches -	0	0	6
	To harrowing ditto -	0	0	6
1792.	To seed for 8 pecks at 1*s.* 6*d.*	0	12	0
April 17.	To harrowing and rolling 1st time -	0	1	0
28.	To hoeing the 1st time -	0	2	0
May 2.	To hand-weeding the rows -	0	1	6
16.	To hoeing the 2d time -	0	1	6
20.	To hand-weeding the rows -	0	1	0
	To 1 year's rent, &c. -	1	1	0
	Expenses	2	8	6
	Contra Cr.			
Sept. 14.	By produce for 36 bushels, at 6*s.* -	10	16	0
	By sheep-feeding, April 17.	0	3	0
	Clear profit	8	11	6

1791.	*Broad-cast Acre* Dr.	£.	s.	d.
Oct. 4.	To ploughing the land -	0	5	0
	To seed for 8 pecks, at 1*s.* 6*d.*	0	12	0
	To sowing ditto -	0	0	6
1792.	To harrowing ditto 6 times -	0	3	0
April 19.	To ditto and rolling 1st time	0	1	0
May 14.	To weeding the 1st time	0	3	0
28.	To ditto 2d ditto -	0	2	0
	To 1 year's rent, &c. -	1	1	0
	Expenses	2	7	6
	Contra Cr.			
Sep. 18.	By produce for 30 bush. at 6*s.*	9	0	0
	By sheep-feeding, April 20.	0	3	0
	Clear profit	6	15	6
	By gain in favour of the drilled acre -	1	16	0
		8	11	6

N. B. In all these experiments, the value of the straw is supposed equal to the expenses of reaping, threshing, and carrying to market.

"*Experiments on Cabbages—the Soil a hazel-coloured stiff Loam, worth 20s. per Acre.*

1790.	*Horse-hoed Acre* Dr.	£.	s.	d.
Jan. 14.	To ploughing -	0	5	0
Feb. 20.	To harrowing twice -	0	1	0
Mar. 11.	To 12 loads of dung, at 3*s.* (half charged) -	0	18	0
14.	To ploughing 2d time -	0	4	0
April 20.	To drag-harrowing -	0	1	6
	To harrowing -	0	0	6
	To gathering couch-grass	0	1	6
May 14.	To ploughing into 4-foot lands	0	4	0
	To 5000 plants at 2*s.* 6*d.* per thousand -	0	12	6
	To planting ditto 48 inches by 30 -	0	8	6
June 10.	To ploughing from the rows	0	2	6
	To hand-hoeing and hilling	0	3	6
July 1.	To ploughing the land to the rows -	0	2	6
20.	To earthing up with horse-hoe -	0	1	6
Aug. 1.	To hand-weeding and killing vermin -	0	1	6
	To 1 year's rent, &c. -	1	1	0
	Expenses	4	9	0
	Contra Cr.			
Dec. 21.	By value of the crop, 50 tons, at 4*s.* per ton -	10	0	0
	Clear profit	5	11	0

1790.	*Hand-hoed Acre* Dr.	£.	s.	d.
Jan. 15.	To ploughing -	0	5	0
Feb. 21.	To harrowing twice -	0	1	0
Mar. 11.	To 12 loads of dung, at 3*s.* (half charged) -	0	18	0
14.	To ploughing 2d time -	0	4	6
April 20.	To drag-harrowing -	0	2	0
	To harrowing, &c. -	0	0	6
	To gathering couch-grass -	0	1	6
May 14.	To ploughing 3d time -	0	4	0
	To 5500 plants at 2*s.* 6*d.* per thousand -	0	13	9
	To planting ditto 36 inches by 30 -	0	10	6
June 10.	To hand-hoeing and earthing up -	0	12	0
July 20.	To ditto 2d time -	0	7	6
Aug. 1.	To hand-weeding, &c. -	0	2	6
	To 1 year's rent, &c. -	1	1	0
	Expenses	5	3	9
	Contra Cr.			
Dec. 21.	By produce for 41 tons, at 4*s.*	8	4	0
	Clear profit	3	0	3
	By gain in favour of horse-hoed acre -	2	10	9
		5	11	0"

These experiments, it is observed, exhibit at one view the author's general practice in the drill-system; and from them, he thinks, it is abundantly evident that the drill-husbandry is superior to the broad-cast; and that the annual average profit arising therefrom amounts to more than the rent of the land. In a variety of experiments conducted, he says, in the same manner, upon land worth about twelve or fourteen shillings per acre per annum, he never found the annual profits less than twelve or fourteen shillings per acre (upon an average) in favour of the drill-husbandry. But although the advantages of the drill-husbandry are obvious, yet, says he, many farmers are enemies to it, and a much greater number are too indolent to go one step out of the old beaten path. Proper instruments, he also justly observes, are wanting that would come cheap to the farmer, and have the requisites of strength and simplicity to recommend them.

The following detailed accounts of the saving made by seed-corn in the drill method over that of the broad-cast, are given by the Rev. Mr. Close, in the ninth volume of the Transactions of the Bath Agricultural Society.

"*Expense for Seed-corn upon* 131 *Acres of Arable Land, sown in the usual Broad-cast Husbandry, and on the present improved Drill-Husbandry.*

Acres	£.	s.	d.
31 of wheat, 3 bushels per acre, at 7*s.* per bushel - -	32	11	0
26 Early peas, 4 bushels per acre, at 8*s.* per bushel - -	41	12	0
18 Dun peas, 4 bushels per acre, at 5*s.* 3*d.* per bushel -	18	18	0
15 Tick-beans, 3 bushels of seed per acre, at 5*s.* per bushel -	11	5	0
6 Early maz. beans, 3 bushels per acre, at 6*s.* per bushel -	5	8	0
12 Oats, 4 bushels per acre, at 3*s.* per bushel - -	7	4	0
13 Barley, 3 bushels per acre, at 3*s.* 6*d.* per bushel - -	6	16	6
12 Vetches, 3 bushels per acre, at 6s. per bushel - -	10	16	0
Total £.	134	10	6

Acres	£.	s.	d.
31 of wheat, 3 pecks of seed per acre, at 8*s.* per bushel - -	8	2	9
26 Early white peas, 3 pecks per acre, at 8*s.* per bushel - -	7	16	0
18 Dun peas, 1 bushel per acre, at 5*s.* 3*d.* per bushel -	4	14	6
15 Tick beans, 3 pecks per acre, at 5*s.* per bushel - -	2	16	3
6 Early maz. beans, 3 pecks per acre, at 6*s.* per bushel - -	1	7	0
12 Oats, 1 bushel per acre, at 3*s.* per bushel - -	1	16	0
13 Barley, 1 bushel per acre, at 3*s.* 6*d.* per bushel - -	2	5	6
12 Vetches, 1½ bushel per acre, at 6*s.* per bushel - -	5	8	0
Total	34	6	0

Seed in the broad-cast husbandry	134	10	6
In the drill-husbandry -	34	6	0
Saving in the seed-corn -	100	4	6"

It is observed by Dr. Fothergill, in the fourth volume of Communications to the Board of Agriculture, that "of our modern improvements, the introduction of the drill-husbandry has been generally allowed to be the most important. Its great utility in saving of seed, in sowing it at an equal depth, and in keeping the land clean by the intervention of hoeing, has been proved by a variety of experiments, and particularly of late by Mr. Coke, of Holkham, in Norfolk, who from thirteen years experience on a farm of 3000 acres, has found this mode of husbandry far superior to the broad-cast. By drilling six rows at a time, nine inches apart, he sows, he says, an acre in an hour with a single horse, allowing only 7 pecks of seed, which is scarcely half the quantity usually sown in broad-cast. He not only saves a bushel and a half of wheat per acre, but also obtains twelve bushels more in the annual crop! Such a diminution in the consumption of seed, though only estimated at 6*s.* per bushel, would, on so large a scale, certainly amount to a very considerable sum! This method is thought," the writer adds, "by some to be equal, if not preferable, to that of dibbling."

As it has been affirmed by some, that the additional tillage necessary for the drill-system more than counterbalances the advantages to be derived from the saving of seed-corn, the first of the above authors assures us, that with Mr. Cooke's scarificators, cultivators, and quitch-rake, he can completely pulverize, and cleanse from weeds, any given quantity of land, at a little more than a quarter of the expense necessary to make an equally-good fallow with the common implements of husbandry. Neither, says he, is additional tillage absolutely necessary, as many slovenly drill-farmers till their lands less than their equally-slovenly broad-cast neighbours.

The saving of seed, as it must be universally admitted that a quantity unnecessarily great is often sown, is, however, Mr. Donaldson thinks, no doubt an object that merits attention, and to effectuate which, drill-machines are well calculated. And that weeds should be destroyed, and the soil pulverized and ex-

posed to the influence of the sun and air, must also, he thinks, be agreeable to the ideas of every good farmer. But that although the principles of this new system of husbandry may be correct, and such as carry conviction along with them, yet *some* of the methods of practice may not, he conceives, from various causes, so readily meet general approbation.

The minutes recorded by Mr. A. Young, in the Agricultural Survey of the County of Lincoln, seem not, however, to place the practice of drilling in so advantageous a point of view.

In speaking of it, he says, in this branch of husbandry Mr. Cartwright has practised largely, to three, four, and five score acres; and one year to one hundred and fifty. This year has fifty. He drills equidistant, with Mr. Amos's drill, eight inches; having found that when wheat has been at one foot, it ripened much later. and was an inferior crop, in every respect, to the eight inches adjoining, which is the distance for all white corn. Beans at twenty-four, and three inches deep; wheat two and a half; and oats two. Quantity of seed; oats four bushels; wheat two; and beans two to two and a half. Is clear that a greater saving of seed than this is pernicious; which amounts to one-fifth, upon comparison with broad-cast. The object is hoeing; breast-hoeing twice the white corn, and hand-hoeing the beans;—the former 2*s*. an acre each time; but if the land is clean, once is enough. Also, if wanted, hand-weeded. The result has been, sometimes the crops have been better than broad-cast, but not always; on the average, it has the advantage. Thinks that the superiority is not so great with corn as with woad.

Lord Brownlow's father was at a considerable expense, he says, to procure instruments of the best kind for practising the drill-husbandry, and spared no expense in conducting it; but was convinced, upon experience, that it was not so profitable as the common method. There has been a good deal of drilling with Mr. Cook's plough, about Grantham; but it does not spread; on the contrary, many have abandoned it.

Mr. Harrison at Norton has, he says, tried Cook's drill, but laid it aside; not from defects in the tool, but the husbandry will not do there. The soil, a friable sandy loam.

Mr. Scrivenor of Barton, drilled turnips in 1796, at eighteen inches, and they were the best, he says, in the lordship; some other person in the neighbourhood have done the same, and with very good success.

Mr. Graburn of Barton, has drilled barley, and various other crops, and had good ones; yet he finds the system so tedious, Mr. Young says, that he has given it up, and now sows all broad-cast.

Mr. Linton has, he adds, been a driller, and an attentive one of wheat, oats, and barley; but finding that it would not answer, gave up the practice.

Mr. Parkinson for some years, he observes, practised the drill-husbandry with Mr. Cook's drill, and by one from Lancashire, and has had good barley; also peas, and wheat; he has this year only seventeen acres of barley drilled, and that is the worst crop on his farm.

Mr. Cod of Ranby, began drilling, he says, in Mr. Ducket's method ten years ago; he bought a complete set of his tools; and he saw some large fields of turnips that would do credit to any farmer; also a barley stubble quite clean. Mr. Lofft's opinion of this husbandry is, that it answers perfectly well for turnips, and prefers it as better; the land quite clean, and at a smaller expense than the common way: he approves it also for wheat and barley; but will never use it for oats, which ought to be sown on rich land; and if not plenty of seed, the weeds will prevail; and, in proof of this, his father sowed four bushels of oats an acre, and the crop was weak and poor: on the same field, after a crop of cole, he himself sowed oats again, eight bushels an acre, and had as fine a crop as could grow; and he has found this to be the case for fourteen years.

The turnips were ploughed for once, he says, with Ducket's skim coulter plough, without the skim; harrow; scuffle; once ploughed with common plough, and sometimes the miner, instead of a ploughing; then harrow; and perhaps scuffle again, and drill; the rows nine inches; scarifies the rows nine at a time; then cross the drills with a single-rowed scuffler. Sometimes this cross in a diagonal direction; hand-work to cut any large weeds, and cut out knots of plants. The horse-hoeing nine rows at a time will do ten acres a day, a man, a horse, and a boy;—running over with hand-hoes, 1*s*. an acre.

Mr. Walker, of Woolsthorpe, has practised the drill-culture largely for wheat, barley, oats, and turnips; but has left it all off:—he has a tolerable opinion of the practice, he says, in very fine weather; then the clovers answer well in this way. But he has no drilled crops on his farm except turnips. From drilling nine gallons an acre of wheat, he has had forty-four bushels an acre over eight acres, on a deep sandy loam.

Such are the facts, Mr. Young says, he met with in this inquiry; they confirm, he thinks, the general result through the kingdom. Drilling, he therefore states, is a practice which will be found to answer to a certain extent, and with a certain degree of skill and attention. But when a minute attention flags, and the scale is much extended, then it is found that the conclusions drawn from one or two fields were not applicable to a whole farm; that the necessary operations militate with other objects; and what was profit becomes loss. Were all the men known who have tried this husbandry, and laid it aside, the advocates remaining would not, in his opinion, figure by their number.

The practice of drill-husbandry may be properly considered under the following heads: 1. Drilling wheat, barley or other white-corn crops, in distinct rows, at from three to five feet distance, with a view to horse-hoeing. 2. Drilling in rows of eight or ten inches distance, with intention to hand-hoeing. 3. Drilling in rows, of the same distance as the last, but only for the purpose of saving seed.

4. Drilling and horse-hoeing green crops, and thereby excluding the necessity of repeated fallowings.

In regard to the first method of drilling wheat, barley, or other white-corn crops, in distinct rows, from three to five feet asunder, and with a view to horse-hoeing, which was the method first adopted by Mr. Tull, and since followed by an individual or two in a few particular districts, Mr. Donaldson thinks, if, after upwards of eighty years practice of it, so few converts have been made, at least who have adhered to it for any considerable length of time, the presumption is, that there is something fundamentally wrong either in principle or practice. If the principle be admitted to be right, which he conceives it certainly is, then the error must, he says, be in the practice. It seems, he thinks, only necessary to mention the distance at which Mr. Tull and his disciples conceived it necessary to drill the rows of wheat, without mentioning the additional circumstance that dung was seldom or never applied, to convince the intelligent farmer of the absurdity of adopting such a method.

Unfortunately, says he, Mr. Tull placed too much faith in good culture, or, more properly, disregarded the benefits which every farmer of the weakest understanding knows are derived from the use of manure. Had that not been the case, he conceives, the practice of horse-hoeing green crops—a practice which is now very generally adopted in many counties, and with never-failing success—would have been introduced at a much earlier period, and the husbandry of the country would ere now have arrived at a much greater degree of perfection.

With respect to the second head, the drilling of white-corn crops in rows of eight or ten inches distance, with intention to hand-hoe, which is a method which has been practised by Mr. Ducat of Esher, in the county of Surry, on probably a larger scale than by any other person in the kingdom. In this way there is a saving of seed. The grains are deposited at the most proper depths, and numbers of poor people find employment. To these may be added—what cannot have escaped the observation of those who have surveyed Mr. Ducat's fields—that they are in a high state of culture, and the crops free from weeds. But that, on the other hand, the extra expense to which Mr. Ducat is necessarily subjected in the management of his farm, in this mode, must be considerable; perhaps, he thinks, greater than any or all the advantages that can possibly result from an adherence to the practice. But it is evident that no generally established mode of culture, in which a great additional number of hands would be requisite, can possibly be adopted in this kingdom, while manufactures continue to increase. Mr. Ducat, as an individual, however, he thinks, deserves praise; and that his labours in the agricultural way have not been in vain, as every person who visits his farm must return satisfied of two facts, namely, "that good culture, and attention to keeping the crops clean," are essentially necessary to the production of valuable crops.

On the third mode of driling in rows, of the same distance from each other as last mentioned, but only for the purpose of saving seed, is, he thinks, a mode that can only be attended with one other advantage beyond sowing broad-cast; that is, the certainty of depositing the seed at the most proper depth. Another, indeed, he says, occurs, and is a necessary consequence of adopting this practice. The land must be in a better state of tilth, to allow the drill-machine to work steadily, than what is always deemed necessary when a field is sown broad-cast. This method of depositing the seed is common in several counties; but whether the saving of the seed, and the superiority of the crops, in consequence of the additional cultivation, are sufficient, or more than sufficient, to counterbalance the extra charge for ploughing, harrowing, and drilling, he has not had sufficient opportunities of procuring information, so as to enable him to draw accurate conclusions.

It is remarked, however, that by much the greatest quantity of grain sown with drill-machines in this kingdom is sown with a view to horse-hoeing. The drill (Cook's for instance), which sows six or eight rows at a time, can with the greatest ease be converted into a hoe, or rather into as many hoes as there are interstices between the rows that are sown at one time. By this means the lands may be cultivated at a trifling expense, while the crop is growing, which cannot be done in the broad-cast husbandry, unless in the manner practised in Gloucestershire, that is, by hand-hoeing. Several of these machines sow or hoe seven or eight rows at once; so that one or other of the operations may be performed over eight or ten acres in the course of a day. It must, he thinks, be agreeable to the sentiments of every person in the least degree acquainted with the subject, that to break the crust that forms, especially on soils of a tenacious nature during winter, must give great relief to the young tender plants of wheat in the spring; and on that account hoeing must be advantageous; but it is worthy of remark, that hoeing a crop of wheat in the spring may tend materially to accelerate or retard its growth, according to the state of the crop at the particular period when the hoeing is performed. If the hoeing be performed when the crop begins to tiller, it will encourage its doing so to a greater degree than if the soil had not been moved, and, consequently, retard the growth of the plants. Whereas, if the hoeing be delayed till the tillering is over, it gives new vigour to the plants, at a season of the year when, without such stimulus, they would spring up only by slow degrees. This, he says, is a remark which those who adopt this method of cultivating wheat will probably find worthy of attention. In regard to spring-corn, the only use of hoeing can be to destroy weeds. That being the case, the writer begs leave to surmise, that when lands are cultivated in a proper manner for receiving the seed, this additional culture must be in a great measure, if not altogether, unnecessary. On the whole, although the hoeing of wheat, when performed at the proper period, must, he thinks, for the reason above-mentioned, be advantageous, yet it does not appear so evident that

the hoeing of oats or barley, or even wheat, when sown late in the spring, and when the land is in such tilth as a good farmer would approve of, is likely to be attended with benefit to the crop, equal to the expense of the additional culture, trifling as it may be stated.

The last method; the drilling and horse-hoeing of green crops, and thereby preventing the necessity of summer fallowing, is, he conceives, not only an improvement on Mr. Tull's system, but one of the greatest that has taken place in agriculture since the introduction of artificial grasses. It is extending the garden-culture to the field, in a manner of all others the most likely to produce beneficial effects. These effects have indeed, he says, already appeared in a manner so conspicuous, as cannot have escaped the observation of ordinary observers, and that renders any further commentary unnecessary. Where the practice of horse-hoeing green crops has become common, fallow, he observes, except on extraordinary occasions, is never thought of, while a wonderful change for the better appears in the culture, and in the superiority of the crops on every farm. This truly admirable method of culture is, however, he thinks, confined chiefly to Scotland, and the north-east of England: but that the advantages resulting from a steady adherence to it require only to be known to render it general in every part of the island.

Where horse-hoeing husbandry is adopted for the culture of turnips, potatoes, beans, cabbages, &c. the land, he says, is ploughed in the ordinary manner three or four times, as occasion requires; and the seeds and plants being inserted at their suitable depths, and in the proper manner, they are afterwards horse and hand-hoed repeatedly during the following season. The consequence of which is, abundant crops are produced, while the land, in place of being injured thereby, is put in probably the very best condition of which it is susceptible, for producing a valuable crop the following season. Who, says he, but those who have had access to know from the best authority, would believe, that while the farmers from Durham, along the eastern coast almost to Inverness, have improved the country, by means of horse-hoed green crops, to a degree almost unknown in any part of the island, still, in several of the most favourably situated counties in England, many of the farmers consider that all the culture requisite to be bestowed on a turnip-crop is finished when the seed is scattered and harrowed in? Yet this is literally the case. Who, continues he, can suppose that the farmers in the counties of Bedford, Lancaster, &c. were they fully informed of the superior crops of turnips, which, by horse and hand-hoeing, are raised in Northumberland, Berwick, Angus, &c. would neglect for a single season so certain means of cleaning their fields, and augmenting the weight and value of their crops?

He concludes by observing, that although he has condemned, without reserve, the horse-hoeing husbandry, as recommended and practised by Mr. Tull; and that though he has hesitated to determine as to the propriety of recommending some of the other methods above mentioned; he is nevertheless under no difficulty in giving it as his decided opinion, that the general introduction of the practice of horse-hoeing and hand-hoeing crops of turnips, potatoes, beans, and cabbages, in rows, at thirty inches or three feet distance, would be a more effectual means of improving the culture, and increasing the quantity and value of the general produce of the kingdoms, than any other that has hitherto been suggested, or that can possibly be adopted.

It is observed by Mr. Amos, in the excellent Practical Treatise already mentioned, that, before the drill-husbandry can be attempted, the land should be brought into tolerable fine tilth. For all land is not equally suitable for the drill and horse-hoeing culture; and some, though comparatively little, not at all so: yet most land, except that which is rocky or abounding with stones, may be brought into proper order, by frequently ploughing, harrowing, and rolling. If the soil is light and dry, one ploughing will, he thinks, be a sufficient preparation. But if the soil is wet, a stiff loam, or a strong clay, the ridges should be ploughed up as early in November as possible. In about three or four weeks after, if the weather permits, the field should be ploughed across with a double mould board-plough into one-bout ridges, and afterwards well water-furrowed by the same plough. The field will then lie in deep open furrows, and high narrow ridges, and consequently exposed to the largest extent of superficies that is possible, which is, he supposes, the *sine qua non* of ploughing. As the spring advances, the ridges must be drawn down by the break or drag-harrow, previous to the seed-furrow for early crops. About the latter end of February, or beginning of March, the ridges should be split down the middle, and afterwards drawn down by the break or drag-harrow, previous to the seed-furrow for the late spring-crops. The land intended for fallow-crops should be treated in the same manner, and afterwards ploughed and properly prepared for the reception of the seed or plants. Where unequal and very high ridges are already formed, they should, he says, be drilled across, until there is time to level them; which may be done with safety in the course of two fallowings, by ploughing the ridges twice down for once up. The land should be formed into ridges of different sizes, according to its quality and the nature of the machine employed. On moist soils they should be narrow, and on dry ones broad, but so set out as to suit the breadth of the drill. From five or six feet to fifteen or eighteen feet are the general dimensions.

In every instance the land, Mr. Amos says, should be well harrowed, and once or twice rolled before it is drilled, and afterwards harrowed once in a place with a pair of light harrows, and then well water-furrowed and gripped, if necessary. In drilling grain, pulse, seeds, &c. the land should neither be

too dry nor too moist, but in a due medium with respect to both, and rather inclining to be mellow and crumbly.

It has been observed by a late practical writer, that in respect to the distances of putting in crops in this way, they have been different in different cases, both in the rows and intervals, according to the particular intentions or views of the cultivator. He supposes that disadvantages must attend their being either too large or too narrow, as in the former there must be a great loss of ground, and in the latter little benefit be derived in the culture of the crops, while growing. "The nature of the land must, says he, probably have considerable influence in regard to the distance of the rows, and the manner of drilling. On the dry light sorts of soil, whether loamy, gravelly, or chalky, that can be constantly ploughed and kept upon the flat, as is the custom in the eastern parts of Kent, close drilling is probably to be preferred as the most advantageous. But on such soils as require ridging, somewhat wider distances may be proper." Mr. Wimpey found, he says, that "drilling three rows eleven or twelve inches asunder, on three-bout ridges, generally succeeded well. The three-bouts, in this way, form a ridge about four and a half feet in breadth; the three rows at the distance mentioned occupying two feet, and the horse-hoe, passing on the side of each outside row, at the distance of three inches, leaves the ridge two and a half feet broad, and the intervals between the ridges about two feet." But he has "further suggested, from remarking that in these cases the outside rows always afford the most vigorous and healthy plants, that two rows only, on two-bout ridges, would be equally productive, and leave the land in better condition." The above writer remarks, that "whatever may be the most applicable and most suitable distances, which experiment does not seem to have yet fully shewn, the very wide intervals of the early practice are to be avoided as improper for all sorts of grain-crops, both on account of the loss that must unavoidably be sustained by the largeness of the spaces, and because the intervals, or spaces between rows, at much less distance, can, in the improved methods of horse-hoeing, be stirred with equal facility and exactness."

It is evident, he supposes, that "for various kinds of green crops, such as cabbages, potatoes, and others of a similar nature, wide distances must be the most proper. But the width of the intervals, and the proportion of seed, that have appeared the most eligible to Mr. Close, after a practice of fourteen or fifteen years, are for wheat, rye, barley, oats, and vetches, on such soils as are not very wet, equidistant rows of one foot, on five or ten-feet ridges. And for beans, peas, and turnips, on three-feet ridges, two rows on each, nine inches apart, with intervals of twenty-seven inches." But according to Mr. Amos, another experienced driller, for "wheat and barley, the distance of the rows and the quantity of seed should greatly depend on the quality of the soil. Where it is poor, the distance between the rows should not be more than about eight inches, nor the quantity of seed more than about nine pecks, being deposited to the depth of two inches and a half. If of a middling quality, the distance between the rows may be about nine inches, and the proportion of seed eight pecks; and where it is rich, the distance of the rows should not ever exceed ten inches, with a quantity of seed of about seven pecks. The latter sort of grain should also have a finer tilth, and not be placed so deep in the soil. And that as oats do not tiller so much as other grains, in drilling them a larger proportion of seed will be requisite."

It is also added, "that as beans and peas afford plants of a very succulent nature, they of course require a greater distance between the rows, and more especially as they are well suited to the horse-hoeing method of culture. He has constantly found twenty-four inches to be the most advantageous distance for such crops, and the depth of about three inches."

He likewise states, that "in the sowing of turnips, rape, &c. on the poorer sorts of soils adapted to the growth of these plants, he has invariably found ten inches to be the properest distance, and on those of the richer description twelve. When they are sown at greater distances, he thinks they are apt to grow too large for keeping any great length of time. If sown at a wider distance, which may, notwithstanding, be proper on such soils as are particularly rich, they should therefore be eaten off before the severe frosts set in, as large turnips are very liable to be destroyed by such weather." And "in putting in carrot-crops by the drill method, fourteen inches between the rows is recommended by the same writer as the most proper distance, the land being slightly harrowed over after the drilling is finished" to cover the seed.

The influence of different distances on the produce in various kinds of grain and pulse-crops cultivated in this method, is well shewn in a tabular form by Mr. Young in his Eastern Tour.

WHEAT CROPS.

Crops.	Distances.	Produce. Q.	B.	
Mr. Fellowes	Eighteen inches	2	5	
Mr. Arbuthnot	Four rows, at 8 inches, on $3\frac{1}{2}$ feet ridges.	2	7	Horse-hoes
Mr. Taylor	Ten inches	4	0	Ditto
Mr. Reynolds	Twelve ditto	2	4	
Thanet	Nine ditto	4	0	Ditto
Ditto	Equally distant	3	4	Ditto
Mr. Anderson	Two rows on five feet	1	4	Ditto
Mr. Cowslade	Eighteen inches	3	4	Hand-hoes
Ditto	One foot	3	4	
	Average	3	1	

BARLEY and OAT CROPS.

Crops.	Sorts.	Distances.	Produce. Q.	B.	
Mr. Arbuthnot	Barley	Double rows, 3, 4, and 5 feet ridges	1	7	Horse-hoes
Mr. Taylor	Oats	Eleven inches	4	4	Ditto
Thanet	Barley	Nine ditto	5	4	Ditto
Ditto	Ditto	Ditto	5	4	Ditto
Ditto	Oats	Ditto	7	0	Ditto
Mr. Pool	Barley	Nine inches	6	0	Hand
Mr. Anderson	Ditto	One foot	3	0	
Ditto	Oats	Ditto	3	3	
		Average	4	4	

BEAN CROPS.

Crops.	Distances.	Seed.	Produce. Q.	B.	Following Crops.
Lemington	. . .	. .	4	0	Wheat
Mr. Canham	Every fourth furrow	$2\frac{1}{2}$	5	4	Ditto, 5 qrs.
Saxmundam	. . .	. .	4	4	
Woodbridge	Sixteen or eighteen inches	. .	6	2	Wheat
Colchester	Nine inches	. .	6	4	Ditto
Mr. Arbuthnot	Various	2	3	3	Ditto
Dartford	. . .	. .	5	0	Ditto
Northfleet	. . .	. .	6	0	Ditto
Sittingburn	. . .	. .	6	4	Ditto
Feversham	Eighteen inches	. .	5	4	Ditto
Beaksburn	Twenty inches	. .	5	0	Ditto
Mr. Taylor	Double rows, sixteen inches on 4-feet ridges	. .	4	0	Barley
Preston	Eighteen to 24 inches	. .	5	0	Wheat
Thanet	. . .	. .	4	4	Ditto
Ditto	Sixteen to 24 ditto	. .	4	4	Ditto
Ditto	. . .	. .	4	0	Ditto
Dover	Eighteen ditto	. .	4	0	Ditto
Sandgate	. . .	. .	4	0	Ditto
Mr. Turner	. . .	. .	5	0	
Mr. Anderson	. . .	. .	1	3	
Donnington	Eighteen ditto	. .	4	4	
Mr. Cowslade	. . .	. .	4	4	
	Average		4	4	

PEA CROPS.

Crops.	Distances.	Produce. Q.	B.	Following Crops.
Tring	Two feet	4	3	Wheat
Mr. Booth	. .	1	4	
Woodbridge	. .	3	4	
Colchester	. .	4	0	Wheat
Mr. Neal	Ten inches	3	0	
Dartford	. .	5	0	Wheat
Northfleet	. .	5	4	Ditto
Sittingburn	. .	3	4	Ditto
Beaksburn	Twenty inches	3	4	Ditto
Thanet	Sixteen to 24 inches	4	0	Ditto
Ditto	. .	4	0	Ditto
Mr. Anderson	Twenty inches	1	1	
Mr. Coombs	. .	3	6	
Donnington	Fifteen inches	4	0	
Mr. Cowslade	. .	4	4	
Reading	Eighteen inches	3	4	
Harleyford	. .	3	4	
	Average	3	5	

The various improvements that have been since made, both in the mode of drilling, and the implements made use of for the purpose, must have had considerable effects on the quantity and the goodness of the produce of crops under this system.

There is, however, still great "difficulty in ascertaining the most suitable distances in different cases, as they must of necessity depend in a great measure upon the nature and state of the soil, as well as that of the crops." It is supposed, "that for grain-crops, such as wheat, barley, &c. from the vast loss of ground that must take place, the great distances practised by Tull can seldom, if ever, be had recourse to with advantage. The experience of drillers, in general, seems, indeed, to have shewn, that on most sorts of soil that are suited to that method, and especially those of the light and dry kinds, the drilling in close rows, or at narrow distances, is by much the most beneficial mode." And it is stated, that "the distances between the rows, and the proportions of seed to the acre, that have been found by an experienced drill-cultivator, to afford the best and largest crops, are from eight to twenty-eight inches in the intervals, and from seven or eight to sixteen pecks of seed, according to the quality of the land, and the nature of the crop. Some latitude may, however, be admitted, as the circumstances of the case vary." This is more fully explained in the table below.

	Wheat.		Barley.		Oats.		Beans.	
Kind of soil.	Quantity of seed.	Distance between the rows.	Quantity of seed.	Distance between the rows.	Quantity of seed.	Distance between the rows.	Quantity of seed.	Distance between the rows.
	Pecks.	Inches.	Pecks.	Inches.	Pecks.	Inches.	Pecks.	Inches.
Poorest	10	8	12	8	16	8	12	18
Poor	9	8	10	8	14	8	10	20
Rich	8	9	8	9	12	9	9	24
Richest	7	10	7	10	10	10	8	28

It is added, on the authority of much experience, by Mr. Close, that "for white corn-crops, nine inches answer extremely well; but that for peas, tares, turnips, and other similar crops, eleven inches is the distance that succeeds the best; and that for beans, eighteen inches are not more than is necessary. It has likewise been found, in respect to this last sort of crop, by Mr. Exter, that when drilled in two rows at nine inches, with an interval of twenty-seven, if weeded sufficiently early, and ploughed between in the method recommended by Mr. Cook, it becomes extremely thick and fine" in quality.

It is, on the whole, stated by a late practical writer, that this sort of husbandry "affords the means of dis-

tributing the seed with a much greater degree of exactness, both in respect to the depth and the regularity of the rows, than in the other mode, by which the crops not only vegetate and grow up in a more equal manner, but by cultivation are capable of being more effectually assisted in their after-growth, and at the same time there is a considerable saving in the quantity of seed. And as the grain by such means is neither too thickly crowded together, nor too thinly scattered in the drills, there cannot be any injury in the weakness of the crops from the former cause, or loss from the too scanty number of stems and ears in the latter, which must always be more or less the case in the broadcast method of management. Besides, from the equality of the depth to which the seed is deposited in this way, in addition to the advantages that have been just noticed, the crops become ripe in a more equal and uniform manner." And "in the assisting of the growth of the crop by the frequent stirring and breaking of the earth about it, for a considerable part of the time it is upon the ground, benefits must also be derived in different ways. By turning the earth in different directions, the mould must become, not only more completely pulverised, but also newly and more fully aërated, in consequence of which various nutritious materials must be more abundantly provided; while, at the same time, the soil is rendered more easily penetrable by the superficial roots of the grain, and the power of tillering or sending forth new roots and stems increased by the earth being laid up to such of the joints of the corn-stems as are immediately above the surface. By this means the same advantages are, indeed, in some measure obtained, as by transplanting and setting the roots of the plants deep in the earth, with considerable savings in the expense of labour. There are likewise other ways in which utility may be derived in this method of management, as by the more complete destruction of weeds that takes place, and the harvesting of the crops, in consequence of it, being accomplished with more certainty and less trouble and expense, as well as by the land being left in a more mellow and productive state for the growth of future crops." It is added, that "from the fine state of pulverisation in which the soil is kept by this method, and its being more free from weeds, advantages may sometimes also be gained in the way of preparation for putting succeeding crops into the ground, which could not be obtained in any other manner," or by any other cultivation.

The reason of its not becoming general has been suggested to be, by the same writer, "the difficulty of bringing common labourers acquainted with the practice, the incorrectness of the machinery commonly employed in delivering the seed, and the expense with which it is at first attended; but there are others which have probably had an equal if not greater effect in retarding its progress, as the applying it to lands in an improper condition, both in respect to quality and the state of tillage, and the either wholly or partially neglecting the after-management of the crops, upon which, it is obvious, much must depend. It is supposed probable also, that by attempting too great savings in the quantity of seed, and allowing it to be sown too thinly, both in respect to the drills and the distances of the rows, the practice may in many instances have been brought into disrepute." It is, however, sufficiently shewn in the numerous comparative experiments stated above, that "where the nature of the ground and the state of tillage are such as to admit the implements to perform the business in a proper manner, and where a proper and regular attention is bestowed on the after-management of the crops, it is a method that has not only advantages in the ways that have been mentioned, but much superiority in the quantity and quality of the produce, as well as the more perfect tillage of the land."

It is stated, that "the sorts of land on which this method of putting in the seed may be had recourse to with the greatest probability of success, are all those of the lighter and more mellow kinds, that are not so strong as to obstruct or impede the operation of the drill, and such of the heavy descriptions as have been brought into a state of tolerable fineness, and are not too wet or stiff to hinder the action of the machine; but that it can probably seldom or ever be employed to much advantage, except, perhaps, for some particular sorts of crops, on those of the heavy and stiff, wet, clayey kinds, as the operation must always be liable to be incompletely performed; nor on such as are of a very stony nature can it be made use of in a proper manner, as the stones will constantly be liable to derange the operation of the drill, and render the distribution of the seed irregular and incomplete." And in very wet seed-seasons, it must, it is supposed, "give way in many cases to the broadcast method, especially on the wet and heavy descriptions of land, as under such circumstances the operations of the drill would scarcely ever be performed with that regularity and exactness which is necessary" for the purpose.

It is advised, that "in whatever kind of soil, and wherever the method of sowing by the drill is attempted, it will invariably be proper, besides suiting the crop to the quality of the soil, to proportion the quantity of seed to the nature of the land, and the distance of the rows to that of the crop, and likewise keep up a constant and minute regard to the culture of the crop," during the period it is upon the ground.

Drill-*Machine*, a contrivance for the purpose of sowing or depositing any kind of grain, pulse, or seeds, in rows or drills at equal distances. Various implements of this nature have been invented at different times, though few have probably been found to answer the purpose with that degree of exactness and regularity that is requisite in this mode of putting crops into the ground. The chief circumstances to be attended to in the construction of this sort of machines are, that they be so simple in their forms as to admit of being managed by the ordinary labourer with ease and facility; that they be capable of being afforded at a cheap rate, in order that they may be more generally employed; that

they be so contrived as to deposit the seed with due regularity both in respect to quantity and depth; that they be capable of being readily set to different distances, to suit different sorts of seeds; and that in the operation of delivering the seed, they do not bruise, break, or in any way injure it. By having these points in view, much simplification and improvement may probably yet be made in the construction of machines of this sort. Drill-machines have considerable variation of form, according to the particular sort of seed which they are designed to sow, the number of rows which they sow at one time, and the distances at which they are sown. They are mostly made so as to be drawn by horses; though in some instances and for some purposes the strength of a labourer is sufficient to perform the business without them. From what has been already observed in speaking of drill-husbandry, it seems probable that some sort of machines of this nature were employed at a much earlier period than has been generally supposed.

In the choosing of these sorts of implements, the farmer should be directed by the nature of his soil and situation, as well as the kind of grain which is to be cultivated, and the size of the farm. But in all cases, the more simple the construction of such machinery is, the better the work is performed.

As the number of machines of this sort, that are in use in different districts, is very great, much regard should be had to the practical application of such tools before they are purchased. Several of those most commonly employed in practise are described below, and others will be found under the particular sorts of crops for which they are employed. See *Drill-Plough*.

Drill-*Barrow*, a sort of small drill made somewhat in the form of the common barrow, for the purpose of sowing horse-beans, turnips, and such like seeds, upon small ridges. In using it, the labourer for the most part wheels it before him, the seed being afterwards covered by means of a slight harrow. Much improvement might be made on this drill, by constructing it so as to drill several rows at the same time, and rendering it capable of being set to different distances. It is represented at *fig.* 4. *pl.* XXXI.

Drill-*Plough*, an implement or machine contrived for the purpose of making drills or furrows, and sowing grain, pulse, or seeds of any kind, in rows, and which is essential in the practice of drill-husbandry. The earliest invention of this sort made in this country was probably that of Worlidge's. The *sembrador* invented by Don Joseph de Lucatello, a Spaniard, was also an early discovery. Many others have since been invented by Mr. Tull, the ingenious discoverer or improver of drill-husbandry, and others who have attended to the cultivation of crops in rows. The Rev. Mr. Cook constructed a useful machine of this sort, which he has since improved and rendered capable of being converted into a horse-hoe (see *Horse-Hoe*), the superior advantages of which chiefly consist, 1st In the wheels being so large that the machine can travel on any road without trouble or danger of breaking; also from the farm to the field, &c. without taking to pieces; requiring only half the draught which the old machine required. 2d, In the coulter-beam, with all the coulters, moving with great ease, on the principle of the pentagraph, to the right or left, so as to counteract the irregularity of the horse's draught, by which means the drills may be made straight: and where lands or ridges are made $4\frac{1}{2}$ or $9\frac{1}{2}$ feet wide, the horse may always go in the furrow, without setting a foot on the land, either in drilling or horse-hoeing. 3d, In the seed supplying itself regularly, without any attention, from the upper to the lower boxes as it is distributed. 4th, In lifting the pin on the coulter-beam to a hook on the axis of the wheels; by which means the coulters are kept out of the ground at the end of the land, without the least labour or fatigue to the person who attends the machine. 5th, In going up or down steep hills, in the seed-box being elevated or depressed accordingly, so as to render the distribution of the seed regular; and the seed being covered by a lid, and thus screened from wind or rain. But these advantages, though considerable in the process of drilling, are nothing, when compared with those which arise from the use of the horse-hoe; with which from eight to ten acres of land may be hoed in one day, with one man, a boy, and one horse, at the trifling expense of 6*d.* or 8*d.* per acre, in a style far superior, and more effectual, than any hand-hoeing whatever, also at times and seasons when it is impossible for the hand-hoe to be used at all. The trials that have been repeatedly made with it fully prove, that, by a proper and seasonable use of this drill and horse-hoe, the largest farm in this island may be kept as clean from weeds as any garden, with a clear extra profit of more than the rent of the land.

It is represented in *pl.* XXX. where *a a*, *fig.* 1. are the shafts of the machine, applied to the axis of the wheels, so that the horse may go on the land, or in the furrow, without setting a foot upon the land, either for the purpose of drilling or horse-hoeing.

b b, the wheels.

c c, coulter-beam, with holes or mortices for the coulters at different distances.

d d, handles of the machine, applied to the coulter-beam, also to the axis of the wheels, by hooks and eyes, or staples.

e e, upper seed-box in partitions, covered by a lid, to protect the grain or seed from wind or rain.

f f, lower seed-box in partitions.

g g, slides between the upper and lower seed-boxes, for regulating the quantity of seed sown.

h h, cylinder with cups or ladles of different sizes, for different sorts of grain or seeds; by which the grain or seeds are taken up, and dropped into the funnels *i i*, and conducted thereby into incisions or drills made in the land by the coulters *k k*.

l, a hook applied to the axis of the wheels.

x, a chain applied to the coulter-beam, the last

link of which, being put upon the lowest hook, will prevent the tubes of the funnels from being displaced, when the machine is crossing deep furrows or gutters.

m, a pin of iron projecting from the coulter-beam, which being lifted on to the hook *l*, at the end of the land, will bear the coulters out of the ground, while the machine is turning round, or on any other occasion, without any labour to the person who attends the machine, in supporting them.

n, a cog-wheel.

o, a cog-wheel, turned by the wheel *n*.

p, a lever and string, passing over a pulley to the axis of the cylinder *h*, by moving the lever *p* to the notch in the staple *q*, the wheel *o* will be lifted out of generation with the wheel *n*, by which means the distribution of grain or seed may be stopped at pleasure, in an instant, at the end of the land, or on any other occasion.

r, an iron bar with holes in it, by means of which, and a pin going through the holes, the seed-box may be elevated or depressed, so as to keep the lid of the box horizontally level, whether going up or down steep hills, or on level ground.

f f, two staples in the ends of the seed-box, for the reception of two slips of wood, with canvas to prevent the wind from interrupting the grain or seed; also to prevent dirt or soil falling from the wheels into the funnels *i i*.

The horse-hoe is represented at *fig.* 2. which shows the shafts, the axis, and wheels, the coulter-beam, with handles, &c. as in *fig.* 1. being part of the said machine, and convertible into a horse-hoe with six shares, by taking away the seed-box *e e*, the cylinder *h h*, the funnels *i i*, and the coulters *k k*, as in *fig.* 1. and introducing the hoes *a a a a a a*, *fig.* 2. in the places of the coulters.

b, a guide projecting from the hoe-beam, which is useful in influencing the direction of the hoes, so as to avoid cutting up the rows of corn. For the mode of managing this machine, see *Horse-Hoe*.

Directions for using the Drill-Machine.—The process of drilling should never be attempted but when the soil is dry, at least so dry as not to stick like daub to the feet in walking over it, unless to regain a late, or in other respects a lost fertility. If the soil abounds with large dry clods, they may be reduced by a heavy roller; but sometimes a spiked roller is necessary for that purpose. Previous to land being drilled, it should also be ploughed deep, and harrowed slightly to level the surface, as has been already shown.

Fig. 1. exhibits a back view of the machine, when put together for working. When the horse is put in the shafts, care should be taken that the chains or tugs by which he draws are of equal lengths, otherwise the machine will have a constant tendency to deviate from the horse's line of traction. But when the horse goes in the furrow, the near side may be somewhat shorter; and a chain may be extended from the end of the cross-bar to a part of the shaft near the horse's shoulder. In going from the farm to the field, or returning from the field to the farm, the pin or guide *m* must be lifted on to the hook *l*, which will bear the coulters off the ground. And when going on rough roads, if the coulter-beam *c c* and the axis of the wheels are lashed together by a rope or chain, it will prevent the coulters receiving any injury, by coming suddenly to the ground.

The grain or seed must be put into the upper boxes *e e*, an equal quantity in each box.

The cups or ladles upon the cylinders are of four different sizes, and are distinguished by the numbers 1. 2. 3. 4.

No. 1. the smallest size (painted white) for lucerne, clover, cole, rape, &c. and will sow two pounds per acre. Also for turnip, and will sow one pound per acre; every other cup being stopped up with a little soft clay.

No. 2. (painted red) for wheat.

No. 3. (painted green) for barley.

No. 4. (painted yellow) for beans, oats, peas, tares, &c.

By raising or lowering the slides *g g*, a greater or less quantity of grain or seed may be sown at pleasure.

When the slides *g g* are as low as they can be, the wheat-cups painted red will sow something more than three pecks of wheat per acre; and more in proportion the higher they are raised, not exceeding one bushel and a half, when raised as high as they can be, in rows at nine inches apart.

The cups painted green, when the slides are as low as they can be, will sow one bushel of barley per acre; and more in proportion as the slides are raised, not exceeding two bushels, in rows at nine inches apart.

The cups painted yellow, when the slides are as low as they can be, will sow almost two bushels of beans, oats, peas, &c. per acre; and more in proportion as they are raised.

Upon soils well cultivated, it is recommended not to sow more than one bushel of wheat per acre.

Barley, from one bushel to a bushel and half per acre.

Beans, from two, to two bushels and half per acre.

Peas, two bushels per acre.

Oats, two bushels and half per acre.

Tares, two bushels and half per acre.

The idea of over-stocking the drills with seed is very absurd. The crops will be materially injured by so doing.

It is recommended to make experiments upon different soils, by sowing different quantities of seed, in order to ascertain the most approved quantity per acre.

If land is in a high state of cultivation, it is hardly possible to sow too little seed, provided the distribution is regular.

The funnels *i i* are all numbered, 1. 2. 3. 4. 5. 6. and for drilling at nine inches must be applied to their respective places, so as to correspond with the

number 1. 2. 3. 4. 5. 6. of the seed-box; six coulters being fixed in the coulter-beam, at the distance of nine inches from each other.

For drilling at twelve inches apart, five coulters must be fixed in the beam, at eleven inches and a quarter from each other, when the order of the funnels will stand 1. 4. 5. 2. 3. 6. and no seed put in the box opposite the funnel No. 5. when placed as above; the waste funnel may be stopped with paper to receive any seed that may accidentally fall therein.

For drilling at eighteen inches apart, three coulters must be fixed in the left end of the beam at eighteen inches from each other, when the order of the funnels will stand 1. 2. 3. 4. 5. 6. and seed put in the boxes opposite the funnels 1. 3. 5. only, the other boxes being empty.

For drilling at twenty-two inches, three coulters must be fixed in the beam, one at each end, and one in the middle, when the order of the funnels will stand 1. 4. 5. 2. 3. 6. Seed being put in the boxes, opposite the funnels 1. 5. 6. only, the other boxes being empty.

Two rows of peas at nine or twelve inches apart, and a space of twenty-two inches alternately, has been tried and approved.

In level lands, without ridge and furrow, if the attendant on the machine cannot find a straight side to begin at, he should mark out with sticks or bushes a straight line, along one side of the field, for his direction; and when drilling at nine inches, in order to make the space between the two adjoining drills, as he returns, equal to the rest, the wheel of the machine must be brought very near the last impression of the coulter, and three inches more distant from the last impression of the coulter, when drilling at twelve inches. And of other distances accordingly.

As the machine approaches the land intended to be drilled, the lever *p* should be lifted from the notch in the staple *q*, when the coulters are two feet on this side the exact place where seed should be deposited; and the pin *m* removed from the hook *l*, by lifting up the handles *d d*.

When the machine arrives at the end of the land, the lever *p* must be moved to the notch *q*, which will stop in an instant the distribution of the seed, and the pin *m* lifted on to the hook *l*, which will support the coulters out of the ground, while the machine is turning round.

If the coulters should not make the incisions or drills something more than two inches deep in light sands or loams, and not quite two inches deep (one and a half is recommended) in strong clays or wet soils, they may be forced into the ground by the hand; or by weights, or a beam of wood four feet long and three or four inches thick, being suspended by chains or cords at the hooks *t t* in the handles of the machine for that purpose.

If, in attempting to make the drills straight, the horse should deviate from his proper direction, the coulter-beam with all the coulters will be readily moved this way or that way at pleasure, so as to make the drills straight by counteracting the irregularity of the horse's line of traction.

If the machine should happen to be too wide for any given ridge, one or more funnels may be stopped with a little loose paper, and the seed received into such funnel returned into the upper seed-box.

In drilling narrow high-ridged lands, the outside coulters may be lowered, and the middle ones raised, so that the points of the coulters may form the same curve which the ridge forms.

The top of the seed-box when shut should be kept horizontally level, whether going up or down steep hills or on level ground. This will make the distribution of the seed uniformly the same. The higher the front edge of the box is raised upon the bar *r*, the seed will descend more copiously into the lower boxes, consequently a greater quantity will be distributed.

It is apprehended, that if the driver of the machine was to sit on the seed-box, and drive with reins, he might conduct the machine much straighter than by leading the horse.

The lower funnels placed behind the coulters should be lashed fast to the coulters with leathern thongs, or cords: and if in lifting up the coulter-beam at the ends of lands, the upper funnels should, by chance, be displaced, a small nail may be driven into the edge of the seed-box, close above the edge of each funnel, which will prevent the funnels being displaced.

If weeds accumulate upon the coulters, they must be displaced by a paddle; if the land is dry, weeds will not be very troublesome; but if wet and clammy, and full of quitch, it will be troublesome, and, more or less, prevent the seed being distributed regularly in the drills. Such lands had better be made a fallow of, in order to clear them from weeds, than drilled with any corn whatever. This would be productive of great profit to the cultivator, and more credit to the drill system at large.

When a piece of land is drilled, it must be harrowed once in a place with common light harrows to cover the seed, and level the surface of the soil, as a preparative for horse-hoeing. If the harrows are taken in the direction the drills are made, there will be no danger of displacing the seed.

Seed-wheat should be limed and brined two or three days before it is used, and made dry by spreading it thin on a boarded floor, to prevent its heating, so as to kill the seed: if seed-wheat is fresh limed and brined, the lime, by acting as a cement, may cause it to clog in the cups. If this should happen upon the field, in hazy foggy weather, so much unlimed wheat as will make it separate may be mixed therewith.

Wheat should not, on any account whatever, be deposited more than two inches deep (one inch and a half is recommended) in strong clays or wet soils, nor less than two inches deep in any dry soils. The most approved depth is readily ascertained in soils of different textures, only by observing at what depth under the surface of the soil the secondary or coronal fibres of plants are formed in the spring.

Lands formed into level ridges, four feet six inches wide, exclusive of the furrows, in strong retentive clays and wet soils, and nine feet six inches wide, exclusive of the furrows, in all dry soils, are best calculated for the practical purpose of drilling, &c. in which case the horse will always go in the furrow without setting a foot upon the land.

Land intended to be drilled with carrot-seed should be deep ploughed; and for every half acre of land, one bushel of saw-dust and one pound of carrot-seed should be provided.

The saw-dust must be well dried and sifted, to take out all the lumps and chips, and divided into eight equal parts and heaps. The carrot-seed must likewise be well dried, but not so as to kill the seed, and rubbed between the hands, to take off the beards, that it may more readily separate; and being also divided into eight equal parts, one of the above parts of saw-dust and a part of carrot-seed must be well mixed and incorporated together; and so on with all the respective portions of saw-dust and carrot-seed, till they are well mixed and incorporated together; which state, in the saw-dust with carrot-seed intermixed, may be drilled with the cups or ladles, No. 2. already described. Carrot-seed resembling saw-dust very much in size, roughness, weight, adhesion, &c. being well mixed with it, will remain so mixed during the sowing. One of the cups, No. 2. filled with saw-dust, will, upon an average, contain three or four carrot-seeds, by which means carrot-seed will be as regularly distributed in the drills as any other grain or seed whatever.

If the wind should be high, when carrot or any other light seeds are sown, it may be necessary to fix a screen of mat or canvas before the seed-box, to keep off the wind. By this, and the two side-wings, *s s*, the seed will be perfectly screened from wind or rain.

Darwin's Improvement of Tull's Drill.—It is remarked by Dr. Darwin, in the Appendix to his Phytologia, in speaking of the improvement which he has suggested in the drill-plough invented by Mr. Tull, that "the first experiment he tried to improve that valuable machine was by enlarging the axis of the seed-box of it into a wheel of sixteen inches diameter, with excavations in the rim to raise portions of the corn above the surface of that in the seed-box. But he found to his surprise the friction of the corn to be so much greater than he expected, when six such large wheels were immersed in it, that an additional hopper became necessary to deliver the seed slowly into the seed-box, as in Mr. Cook's drill-plough; which, as it would add much to the intricacy and expense of the machinery, and to the inaccuracy of the quantity of seed delivered, occasioned him to relinquish that idea; and after many designs and many experiments to construct the following machine, which he believes to be more simple, and consequently less expensive to construct, and less liable to be out of order, and to deliver the seeds of all kinds with greater accuracy, than any drill-machine at present in use; and that it possesses every other advantage that they can boast. It is represented at *fig.* 5. *pl.* XXX.

"*Construction of the Carriage part*:—*a a*, are the shafts for the horse, which are fixed to the centre of the axle-tree by a simple universal joint at *z*; whence, if the horse swerve from a straight line, or is purposely made to pass obliquely, to avoid treading on the rows of corn in hoeing, the person who guides the plough behind may keep the coulters of the plough or hoe in any line he pleases; which is thus performed with much simpler mechanism than that used in Mr. Cook's patent plough for the same purpose, which has many joints like a parallel rule. *b b* are the horns or shafts behind, for the person who guides the drill-coulters or hoes; they are fixed to the axle-tree before, and have a cross-piece about six inches from it at *g g*, for the purpose of supporting the seed-box described below. Behind this, about a foot distant from it, is another cross-piece at *c c*, called the coulter-beam, which is fifty inches long, six inches wide, and two inches thick; it is perforated with two sets of square holes, six in each set, to receive the coulters in drill-ploughing, and the hoes in horse-hoeing. The six light square holes are nine inches from each other, and are to receive the coulters or hoes in the cultivation of wheat, the rows of which are designed to be nine inches from each other, and the six dark square holes are placed seven inches from each other, to receive the coulters or hoes for the cultivation of barley, the rows of which are designed to be but seven inches distant from each other. Besides these there are six round holes through this coulter-beam at one part of it, and six iron circular staples fixed into the edge of the other part of it; these are to receive the ends of the tin flues, which cross each other, and convey the seed from the bottom of the seed-box into the drills or furrows, when the coulters are disposed in the square perforations before them. These coulters, or hoes, the person who guides the machine can raise out of the ground in turning at the ends of the lands, or in passing to or from the field, and can suspend them so raised on the iron springs *d d*, which at the same time so fixes the shafts to the axle-tree, that the wheels will then follow in the same line with the horse. *e e* are wheels of four feet in diameter, the nave of one of which has on it a cast-iron wheel at *f f*, for the purpose of turning the axis of the seed-box, which has a similar wheel of one-fourth of its diameter; whence the axis of the seed-box revolves four times to one revolution of the wheel.

"*Construction of the Seed-box*.—This consists of boards about an inch in thickness, is forty-eight inches long within, twelve inches deep, twelve inches wide at top, and six inches wide at bottom. It is divided into six cells, in which the corn is to be put, as represented at *fig.* 6. and should also have a cover with hinges to keep out the rain, and is to be placed in part over, and in part before, the axle-tree of the carriage, at *g g*, *fig.* 5. Beneath the bottom of the seed-box passes a wooden cylinder, at *h h*, *fig.* 6. with excavations in its periphery to receive the grain.

from the six cells of the seed-box, *l m n o p q*, and to deliver it into the six oblique flues *i i*, which are made of tin, and cross each other, as represented in the plate. The use of the seed-flues thus intersecting each other is to increase the length of the inclined surface, on which the seed descends, that if six or eight grains be delivered together they might so separate by their friction in descending as not to be sown together in one point, which might be liable to produce tussocks of corn. As these seed-flues cross each other, before they pass through the coulter-beam at *c c*, *fig.* 5. it was necessary to make three of the round holes of the coulter-beam at one end backwarder than those at the other end; and on that account to use iron staples or rings at one end instead of perforations, as at *w w*, *fig.* 5. These tin flues deliver the seed at the time of sowing into the small furrows or drills, which are made by the coulters before them. These seed-flues have a joint at *z z*, where one part of the tin tubes slides into the other part, and they by these means can be occasionally shortened or lengthened to accommodate them to the coulters, when placed at seven inches distance for sowing barley, or at nine for sowing wheat. At the bottom of this seed-box are six holes, one in each cell, to deliver the corn into the excavations of the cylinder, which revolves beneath them. These holes are furnished on the descending side, as the cylinder revolves, with a strong brush of bristles about three-fourths of an inch long, which press hard on the tin cylinder. On the ascending sides of the revolving cylinder the holes at the bottom of the seed-box are furnished with a piece of strong shoe-soal leather, which rubs upon the ascending side of the cylinder. By these means the corn, whether beans or wheat, is nicely delivered, as the axis revolves, without any of them being cut or bruised.

"*Construction of the iron Axis and wooden Cylinder beneath the Seed-box.*—This is shown at *fig.* 7. An iron bar is first made about four feet six inches in length, and an inch square, which ought to weigh about fifteen pounds. This bar is covered with wood, so as to make a cylinder four feet long, and two inches in diameter, as at *k k*. The use of the iron bar in the centre of the wood is to prevent it from warping, which is a matter of great consequence. This wooden cylinder passes beneath the bottom of the seed-box, and has a cast-iron cog-wheel at one end of its axis, as at *r r*, which is one-fourth of the diameter of the correspondent cast-iron wheel, which is fixed on the nave of the carriage-wheel, as at *fig.* 5. *f f*, so that the axis of the seed-box revolves four times during every revolution of the wheels of the carriage. In the periphery of this wooden cylinder are excavated four lines of holes, six in each line as at *n n n n n n*, *fig.* 7. A second line of excavation is made opposite to these on the other side of the cylinder, and two other lines of excavations between these; so that there are in all twenty-four excavations in the wooden part of this axis beneath the seed-box, which excavations receive the corn from the seed-cells, as the axis revolves, and deliver it into the flues shown at *fig.* 6. *o o i i*, not unsimilar to the original design of the ingenious Mr. Tull. The size of these excavations in the wooden cylinder to receive the seed are an inch long, half an inch wide, and three-eighths of an inch deep; which are too large for any seeds at present employed in large quantities, except beans, but have a method to contract them to any dimensions required, by moving the tin cylinder over the wooden one, as explained below at *fig.* 8.

"*Construction of the Tin Cylinder.*—*a b*, *fig.* 8. represents a cylinder of tin an inch longer within than the wooden cylinder on the iron axis at *fig.* 7. and is of two inches diameter within, so as exactly to receive the wooden cylinder, which may slide about an inch backwards or forwards within it. *c d*, *fig.* 8. are two square tin sockets fixed on the ends of the tin cylinder, to fit on the square part of the iron axis, which passes through the wooden cylinder at *l l*, *fig.* 7. on which they slide one inch backwards or forwards."

It is observed, that the following directions in making the holes in this tin cylinder, and those in the wooden cylinder, which are to correspond with them, must be nicely attended to. "1st, when the tin cylinder is soldered longitudinally, and one end of it soldered on, as at *a*, *fig.* 8. six holes through it must be made longitudinally on four opposite sides of it; each hole must be exactly half an inch wide, and five-eighths of an inch long; the length to be parallel to the length of the cylinder. The centre of the first of these holes must be five inches distant from the closed end *a*: the centre of the second hole must be eight inches distant from the centre of the first; and so on till six holes are made longitudinally along the cylinder. Then another such line of six similar holes is to be made on the opposite side of the cylinder, and then two other such lines between the former, in all twenty-four; and the size of all these holes must be nicely observed, as well as their distances. 2dly, The wooden cylinder fixed on the axis is now to be introduced into the tin cylinder, but not quite to the end of it, but so as to leave exactly one inch of void space at the closed end *a*; and then the size of all these apertures through the tin cylinder, each of which is exactly half an inch wide, and five-eighths of an inch long, are to be nicely marked with a fine point on the wooden cylinder, which must not previously have any excavations made in it. 3dly, The twenty-four holes thus marked on the wooden cylinder are now to be excavated exactly three-eighths of an inch deep, but with an addition also of three-eighths of an inch at that end of every one of them which is next to *a*; so that, when the wooden cylinder is again replaced in the tin cylinder as before, with one inch of void space at the closed extremity of it, the excavations in the wooden cylinder will be three-eighths of an inch longer than the perforations in the tin cylinder over them. These excavations in the wooden cylinder must also be rather narrower at the bottom than at the top, to prevent with certainty any of the grain from sticking in them as they revolve. 4thly, A screw of iron about three inches long, with a square

head to receive a screw-driver, is to pass through the end *a* of the tin cylinder on one side of the axis, as at *x*, *fig*. 8. The screw part of this is to lie in a hollow groove of the wooden cylinder, and to be received into a nut, or female screw, which is fixed to the wooden cylinder. The head part of the screw, which passes through the end *a* of the tin cylinder at *x*, must have a shoulder within the tin cylinder, that it may not come forwards through the end of it; and a brass ring must be put over the square end of the screw on the outside of the tin cylinder, with a pin through that square end of the screw to hold on the brass ring. Thus when the square head of the screw is turned by a screw-driver, it gradually moves the tin cylinder backwards and forwards one inch on the wooden one, so as either to press the end *a* of the tin cylinder into contact with the end of the wooden cylinder within it, or to remove it to the distance of one inch from it, and leave a void space at the end *a*. 5thly, The ends of all the holes of the tin cylinder, which are next to the end *a* of it, are now to be enlarged, by slitting the tin three-eighths of an inch towards *a*, on each side of the hole; and then that part of the tin included between these two slits, which will be half an inch wide, and three-eighths of an inch lengthways in respect to the cylinder, is not to be cut out, but to be bent down into the excavations of the wooden cylinder beneath, so as to lie against that end of the excavation which is next to *a*. But these projecting bits of tin, before they are bent down into the excavations of the wooden cylinder, must be filed a little less at the projecting end, which is to be bent down, than at the other end; as the excavations of the wooden cylinder are to be rather narrower at the bottom than at the top, and these pieces of tin, when bent down, must exactly fit them. Lastly, when all these holes through the tin cylinder are thus enlarged, and the bits of tin filed rather narrower at their projecting ends, and then bent down into the excavations of the wooden cylinder, the other end of the tin cylinder with its square socket may be soldered on. And now when the end of the tin cylinder at *a* is pressed forwards upon the wooden cylinder towards *b*, by turning the screw at *x* above described, every excavation of the wooden cylinder will be gradually lessened, and finally quite closed; by which easy means they may be adapted to receive and deliver seeds of any size, from horse-beans and peas to wheat, barley, and to turnip-seed, with the greatest accuracy, so as to sow four, five, or six pecks on an acre, or more or less, as the agricultor pleases, by only turning the screw a few revolutions one way or the other.

"*Observations*.—1. In the construction of the tin and wooden cylinders beneath the seed-box, another small improvement, it is said, may be necessary in sowing very small seeds, which is this: As the screw at the end *a* is turned so as to contract all the excavations of the wooden cylinder, the surface of the wooden cylinder for one inch from the end of each excavation towards the end *b*, *fig*. 3. will become bare without being covered by the tin cylinder; and on these bare parts of the wooden cylinder, which will be one inch long, and half an inch wide, some small seeds may chance to stick, and evade the brushes, which should prevent them from passing, as the cylinders revolve. To prevent this, when the wooden cylinder is so placed within the tin cylinder that all the holes are quite open, let a piece of the tin cylinder, about an inch and a half long, and half an inch wide, be cut out of the extremity of each hole next to the end *b*, and let this piece of the tin cylinder thus cut out be fixed by a few sprigs on the wooden cylinder exactly in the same place which it covered before it was cut out of the tin one, by which contrivance, when the tin cylinder is afterwards pushed forwards by turning the screw at its end, so as to contract the excavations of the wooden cylinder beneath, the bare parts of the wooden cylinder will exist an inch and a half from the extremities of the excavations next to the end B, and thus will not pass under the brushes, and in consequence no small seeds can lodge in them. 2. Some kind of iron staple should be fixed at each end of the seed-box on the outside; which, when the hinder part of the carriage is raised up by the person who guides it, might catch hold of the two iron springs at *d d*, *fig*. 5. for the purpose of suspending the coulters out of the ground, and connecting the hinder part of the machine with the shafts before; that, in turning at the ends of the lands, or in passing from or to the field, the wheels may not swerve at the joint *z*, at the centre of the axle-tree, but may follow in the same line with the shafts. 3. The seed-box must also be supported on upright iron pins passing through iron staples, with a lever under the end of it next to the wheel *r r*, *fig*. 7. for the purpose of easily lifting that end of the seed-box about an inch high, to raise the teeth of the iron cog-wheel on its axis out of the teeth of the correspondent iron wheel on the nave of the carriage-wheel. 4. The construction of the coulters, which make the drills, and of the rakes, which again fill them, after the seed is deposited, and also the hoes, are not here delineated; as they are similar to those so often described or used by Mr. Tull and his followers. 5. When the lower ends of the seed-flues are placed through the holes in the coulter-beam, *fig*. 5. at nine inches distance from each other, the rows of wheat or beans will then be sown nine inches from each other; and as the wheels of the carriage are four inches in diameter, and therefore travel about twelve feet in each revolution, and as there are four excavations round the axis of the seed-box, which revolve four times for one revolution of the carriage-wheels, it follows that the seeds contained in the excavations of the cylinder beneath the seed-box will be sown at nine inches distance in each drill or furrow, as the plough proceeds; and as these rows are nine inches asunder, any desired number of seeds may be deposited in every square of nine inches, which are contained in the surface of the field."

6. It is stated, that "Mr. Coke, of Norfolk, acquainted him, that on his very extensive farm the wheat sown on an acre was six or seven pecks by the

Rev. Mr. Cook's drill-plough, which was about half the quantity generally used in broad-cast sowing. If the wheat was nicely deposited in the drills, he suspects one bushel would be quite sufficient for an acre, as the rows are at nine inches distance from each other; for there would in that case be about eight grains or nine grains deposited in every nine inches of the drill-furrow, that is, in every square of nine inches contained in the surface of the land so cultivated—which may be thus estimated: Mr. Charles Miller, in the Philosophical Transactions, vol. LVIII. p. 203, has estimated the number of grains in a bushel of wheat to amount to 620,000; and Mr. Swanwick of Derby has lately estimated them to be 645,000. We may, the doctor says, suppose, therefore, that a bushel may at an average contain 635,000 grains of wheat. Now, as a statute acre contains 4840 square yards, and there are sixteen squares of nine inches in every square yard, 4840 multiplied by 16 gives 77,440, which is the number of squares of nine inches in such an acre. If 635,000 grains in a bushel be divided by 77,440, the number of squares of nine inches in an acre, the quotient will show, that rather more than eight grains of wheat will thus be deposited in every nine inches of the drills. 7. Now, says he, if eight or nine grains were dropped altogether in one inch of ground, they would be too numerous, if they be all supposed to grow, and would form a tussock; but by making them slide down an inclined plane, as in the tin flues, from the seed-box to the coulters, which are crossed for the purpose of lengthening them, as seen at *fig.* 6. some of the seeds will be more delayed by their friction in descending than others, and the eight or nine seeds will thence be dispersed over the whole nine inches of the drill; which, he thinks, renders drill-sowing superior to dibbling, as in the latter the seeds are dropped altogether. 8. When the holes in the wooden cylinder are completely open, they are about a proper size for sowing horse-beans or peas: when they are completely closed, there will remain a small niche at the end of the excavation in the wooden cylinder next to *b*, *fig.* 8. for turnip-seed, or other small seeds. For wheat and barley and oats, a wooden wedge should be made of the exact shape of the area of the hole, which the director of the plough requires; who will occasionally insert it into the holes, when he turns the screw at the end of the cylinder to enlarge or to lessen them to these exact dimensions. These wedges should be written upon with white paint, wheat, barley, oats, &c. which will much facilitate the adapting the size of the excavations to each kind of grain, and may be altered, if required, to suit larger or less seeds of the same denomination.

9. It is remarked, that in some drill-ploughs, as in Mr. Cook's, there is an additional machinery to mark a line, as the plough proceeds, in which the wheel nearest the last-sown furrow may be directed to pass at a proper distance from it, and parallel to it. But in sowing wheat or peas and beans this may be done by making the wheels, as they run upon the ground, to be exactly fifty-four inches from each other; and then at the time of sowing to guide the wheel next to the part last-sown exactly in the rut which was last made; by which guide the rows will all of them be accurately at the distance of nine inches from each other.

The Simplicity of this Drill-plough.—1. The simplicity of this machine consists, the doctor observes, first, in its having only a seed-box, and not both a hopper and a seed-box, as in the Rev. Mr. Cook's patent drill-plough. 2. The flues, which conduct the seed from the bottom of the seed-box into the drill-furrows, are not disjoined about the middle of them, to permit the lower part to move to the right or left, when the horse swerves from the line in which the coulters pass, as in Mr. Cook's patent drill-plough; which is done in this machine by the simple universal joint at *z*, *fig.* 5. 3. In this machine the horns or shafts behind, between which the person walks who guides the coulters, are fixed both to the coulter-beam and to the axle-tree; whereas in Mr. Cook's patent plough these are all of them moveable joints like a parallel-rule, for the purpose of counteracting the swerving of the horse; which in this machine is done by the simple universal joint at *z*, *fig.* 5. 4. The altering the dimensions of the holes in the axis of the seed-box by only turning a screw, so as to adapt them to all kinds of seeds, which are usually sown on field-lands. 5. The strong brush of bristles, which sweep over the excavations of the cylinders beneath the seed-box, strickle them with such exactness, that no supernumerary seeds escape, and yet none of them are in the least bruised or broken, as, he believes, is liable to occur in Mr. Tull's original machine. And, lastly, he says, it should be observed, that the less expense in the construction, the less propensity to be out of repair, and the greater ease of understanding the management of this machine, correspond with its greater simplicity, and will, he hopes, facilitate the use of the drill-husbandry.

Mr. Swanwick's Seed-Box.—It is remarked by the doctor, that as the dibbling of wheat is a very slow and laborious method of depositing the corn, and is yet coming, as he is informed, more and more into fashion in some counties, he suspects this must be owing to the expense of procuring, and the difficulty of managing, the drill-ploughs now in use, or to the greater inaccuracy with which they deliver the seed. He flatters himself, therefore, that he is doing a benefit to society in endeavouring to simplify this machine, and to increase its accuracy as much as possible. He, therefore, here describes another method of delivering the seed from the seed-box, which was invented by Mr. Swanwick, an ingenious teacher of writing and arithmetic, with some branches of natural philosophy, in Derby; and who will not, he says, be averse to show the working models of the seed-boxes, or to give assistance to any one, who wishes to construct either this drill-machine or the preceding one.

This seed-box is forty-eight inches long within, is divided into six cells for the purpose of sowing six rows of seed at the same time, like that above de-

scribed. And at the bottom of each cell is a hole *a a*, &c. *fig.* 9. for the seed to pass through into the seed-flues, as in the machine before described: but in this there is no revolving axis, but a wooden or iron bar, *b b*, *fig.* 10. about two inches broad, and about four feet eight inches long, and exactly three-eighths of an inch thick. Through this bar there are six perforations, *e e e*, &c. which are each of them exactly one inch long, and half an inch wide; and three-eighths of an inch deep, which is the thickness of the bar. The centres of these holes are exactly eight inches distant from each other, correspondent to the holes at the bottom of the seed-box; over which it is made to slide backwards and forwards in a groove. By this sliding motion it passes under stiff brushes, which are placed over it on each end of the holes at the bottom of the seed-box, and strickle off the grain as the holes in the sliding-bar pass under them, which thus measure out the quantity with considerable accuracy. In order to increase or diminish the quantity of grain delivered, the slider is covered with a case of tin, *c c*, *fig.* 11. which has six perforations exactly corresponding with the holes in the slider; but, instead of the bit of tin being cut out the whole length of the hole, part of it is left at the end *i*, *fig.* 13. equal to the thickness of the slider, and is bent down as at *b*, after the slider is put into the case, like the tin cylinder in the preceding machine. This case is moveable about one inch backward and forward by turning the finger-screw *s*, *figs.* 11 and 12; and thus the holes are made larger or less to suit various sorts of grain, or different quantities of the same sort, exactly as in the wooden and tin cylinders in the former. The slider is moved forwards by a bent iron pin *h* attached to it, which passes into a serpentine groove *y*, *fig.* 12. fixed to the nave of the wheel; and backwards by a steel-spring at the other end of the seed-box, which is not represented in the plate.

Fig. 12. is a bird's-eye view of the parts before described: *e e*, the seed-box divided into cells by the partitions *d d*, &c. *c c c* the slider, with a part of the apertures seen just appearing from under the brushes. *x*, the axis of the wheel. *w w*, extremities of it.

Fig. 13. is a drawing of part of the tin case, nearly of the full dimensions as to breadth and thickness, but only a small portion of the length, and is intended to show more distinctly the construction of it.

Fig. 14. represents a side-view of one of the six bridges lying over the holes at the bottom of the seed-box, on each side of which the brushes are fixed, which strickle the holes when they are full of corn, as the bar slides backwards and forwards.

The simplicity of this slider at the bottom of the seed-box may, the doctor says, be in some respects greater than that of the wooden and tin cylinders in the former machine, as this has but six holes to measure out the corn, and the other has twenty-four. But perhaps in other respects less so; as in this twelve brushes are used, one on each side of each of the six holes; whereas there are only six brushes rub upon the tin cylinder in the former machine. And the reciprocating motion of this wheel must be quick, as it must act once every time the periphery of the wheel of the carriage has passed nine inches forward; which may not be so easy to execute as the cog-wheel, and uninterrupted movement of the axis and cylinder in the preceding machine. He has only to add, that the facility of adapting the holes to the dimensions required in both these machines, and their not bruising or breaking the grain in their operation of delivering it, as well as their not being incumbered with an additional hopper, which must deliver the quantity of seed with greater inaccuracy from the unequal shaking of the machine, adds much to the excellency and simplicity of them both; and, he hopes, will render more general the use of the drill-husbandry invented by the ingenious Mr. Tull; who was on that account an honour to this country, and ought to have a statue erected to his memory, as a benefactor of mankind, like Ceres and Triptolemus of old.

Mure's Drill-plough is another plough of this description, that may frequently be of great utility in drilling of turnips, and various other crops. It is so constructed as to give a much greater depth of cultivated soil to the roots of the plants than is usual, and at less expense, which are objects of the greatest importance, especially in the growth of turnips. One furrow being drawn straight, the length of the field, and the dung placed in it, every subsequent turn of the plough will form a ridge; gather the dung, and bury it in the middle of it; likewise make a drill; sow the seed in it, and afterwards cover it, forming every ridge of exactly the same height, and in every way similar. And the plants being set out at proper distances, by drawing a common hoe across the drills, it will, with a man, and any old horse, hoe four acres a day, paring the tops and bottoms of the furrows, and mixing the soil, lay it up as before, so as that not a weed is to be seen. Turnip-crops cultivated on this plan have been found much better than in the usual broad-cast method. The land should, however, be in a fine condition. It is constructed with such simplicity as to need but little description. The wheel in its revolution turns the seed-box, which is fixed on the spindle at the end of the axle, and consequently delivers the seed at the distance desired. If the ridges be already formed with two boxes, one at each end of the spindle, two rows may be sown at a time. And if, instead of a hoe, a double mould-board plough be made use of, with the same apparatus, it forms the ridge at the same time that it drills it, one box only being employed. It is represented at *fig.* 1. *pl.* XXXI. in which *a* is the spindle on which the seed-box is fixed; *b b*, the cross-piece in which the drill-coulter, *c*, is fastened; *d*, the mould-board; *e*, the beam; *f f*, the handles; *g*, the copse by which it is drawn.

Drill-ploughs used in India.—In a very interesting and valuable communication inserted in the first volume of Communications to the Board of Agriculture, from Captain Halcott to Dr. James Anderson, physician-general at Fort St. George, it is observed, that until lately he imagined the drill-plough to be a mo-

dern European invention; but a short time ago, riding over a field, he observed a drill-plough at work, very simple in its construction, which upon inquiry he found was in general use here (Innacondah), and has been so time immemorial. This led him to make some further inquiries into their mode of husbandry there; and he finds that the drill-husbandry is universally practised in the Innacondah district, in the culture of all grains, except horse-grain, and is also used in the culture of tobacco, cotton, and the castor-oil plant. In the practice of this husbandry they have, he says, two other ploughs in use here, exclusive of the drill-plough and the common plough: one of these has a horizontal share, and immediately follows the drill-plough at work. It is set into the earth, about the depth of seven or eight inches, and passes under three drills at once. It operates by agitating the earth so as to make the sides of the drills fall in, and cover the seed-grain, which it does so effectually as scarcely to leave any traces of a drill. The other plough alluded to is used after the corn is about eight or ten inches high. It cuts up the weeds between three drills at once, and earths up the roots of the corn at the same time.

He has some reason to think this drill-plough, simple as it is, possesses an advantage that the patent drill-plough does not; for he remembers, he says, reading in some publication, that the patent drill-plough was defective in not dropping the grain equally; this plough has no defect of that kind. It has three teeth about eighteen inches long, and ten inches asunder. Through the upper end of each tooth, near the back, is inserted a hollow bamboo of an inch in diameter, and about three feet in length; these three bamboos are set upright, and their upper ends are brought nearly together, in the form of a triangle, and inserted through the bottom of a wooden cup. This apparatus is supported and made steady by cords in the way of shrouds, which lead to different parts of the plough.

In working the plough, the cup, he observes, is not filled with grain, but is fed by hand. This labour is performed by a woman, who walks on the left side of the plough with a bag or large pocket of grain before her, her right arm stretched out, and her wrist resting on the edge of the cup. Her hand is filled with grain, and by moving her fingers she lets drop into the cup as much grain as supplies the three drills in due proportion. When the grain in her right hand is nearly expended, she fills it again from her left hand, observing never to take her right hand from the cup while the plough is in motion, as that would leave a vacant space in the field. The drill-plough, which drops the grain by some piece of mechanism, will probably never sow a field so equally as is done in this way; and here is, he says, a remedy for the defect complained of in the English drill-plough. Whether the expense of two persons to work this plough may or may not make against its being introduced into England, in preference to that now in use, he leaves to be determined by those who are better acquainted with the subject: yet, he thinks, when it is considered, that supplying the cup is a labour performed by women, and how soon an acre is sown in this way, perhaps it might not be rejected on account of the additional expense, which would be but trifling. The first cost of a plough of this kind, he says, would be but a few shillings, whereas the patent drill-plough is an expensive machine.—A gentleman who was then there on a visit informed him, however, that his grandfather, who farms part of his own estate, practises the drill-husbandry, but found the drill-plough dropped the grain so unequally, that he laid it aside; and now, from a conviction of the superiority of the drill-husbandry, uses a drill-roll, which has a number of pegs upon it, and makes holes in straight lines, into which the seed-grain is dropped by hand. This is a tedious way, and, he informed him, had also its defects, as it is done by children, whose hands, in the cold season when wheat is sown, are apt to get numb, and they often drop too many grains into each hole. However, many prefer this method to the drill-plough at present in use. Whether the plough with a horizontal share for covering in the drills is in use in England, he knows not; if not, it will, he supposes, be an acquisition to those who practise the drill-husbandry. He is also equally uninformed, whether the instrument used there for cutting up the weeds between the drills is known in England. It is simply three small mamoties set upon three teeth, placed at the same distance from each other as the teeth of the drill-plough.

Representations of these drilling tools may be seen in the volume of Communications mentioned above.

Various sorts of drills have been invented for the purpose of sowing turnip-seed in the drill-method. The following is the description of an useful drill-machine, as given by Mr. Donaldson, not only for this purpose, but also that of sowing all sorts of grains and seeds in seven or eight rows or drills at a time, depositing the seed to a regular depth and at equal distances. It is constructed on the novel principle of varying the quantity of it at pleasure, while it is at work, according to the nature of the soil, season, and other circumstances, that may exist. The internal part of the machine, by which the proportion of seed that is to be sown is regulated, is shown at *fig.* 2. in *pl.* XXXI. in which *a x* is an iron axle, one and a quarter of an inch square; upon which are fixed, at eight inches distance, five brass-fluted cylinders, the flutes being rather more than a semicircle, five-eighths of an inch in diameter, or five-eighths wide, and seven-eighths deep. *r m*, are hollow cylindrical rims of hammered iron, which have segments turned down at right angles to fit exactly the flutes of the brass cylinders; the cavities of which are increased or diminished by the segments of the iron cylindrical rims sliding backwards or forwards in the flutes. This is performed in all the cylinders *at the same time*, by a rectangular space *N* being made in the brass cylinders, through which passes a straight piece of iron, *i n*, moving on friction which at *i*, and fastened to the plates at *l k*, and also to the cylindrical rims *r m*. *l v*, is a lever, the fulcrum of which is *f*, and moved by a screw *s*, passing through

the frame at *v*. The end at *l k* is forked, and made to fit *exactly* the sides of the roller or plates of iron *j k*. By moving the screw *s*, the lever moves the whole of the rims at once, and the cavities are increased or diminished as may be necessary, and almost instantaneously so as to sow any sorts of seed in any proportion, as is shown upon the scale *c o p*, by the index *k o*, fixed to the end of the lever at *k*. And this may be performed with the greatest ease and facility while the machine is in motion, a point which is often proper to be regarded, when the land varies much in its quality on the same ridge. The scale is so graduated, as to show the number of grains or seeds of the different sorts that are deposited in each foot. *h w t*, is a part of the back of the hopper, where *w w* shows the fixed part of the tongue that collects the seed into the cavities, and which, by its oblique position, prevents them from being bruised. *t u*, is the moveable tongue, which is elevated or depressed by the screw *T*, to suit grain of different kinds.

Fig. 3. is a representation of the machine when in a state for work. The seed being put into the hopper *h o*, is delivered by the cylinders shown at *fig*. 1. into the spouts *s p*, down which it slides to the coulter *c*; the distances of these being regulated by a square staple, passing through the holes in the rail *r l*; by this means the distance of the rows can be varied at pleasure; while the axle of iron *i k*, by taking up or letting down, is capable of regulating the depth to which the seed is to be sown.

The spouts and coulters are hung upon a loop, and act independently of each other; and by being allowed a little play in the rectangular staples, they pass through every accidental hollow in the land; by which means they constantly deposit the seed in a proper manner in such hollows, which, where the coulters are fixed, is mostly left upon the surface of the ground. Any particular row is prevented from being sown, by putting in the flats or shutters *T*; and the whole are prevented from sowing while turning at the ends, by a small pinion *N* being detached from another placed upon the nave of the wheel.

At the end of *fig*. 2. is represented a section of a brass cylinder of the *real size*. The square space in the middle is for the iron axle; the rectangular one *N* for the iron slides *i n*; and the cavities *c d c* for the grain are formed by describing the fore-part *c d* from the centre *a*, with a radius of one-sixteenth of an inch; and the back-part *d c* from the centre *b*, with a radius of three-eighths of an inch. *e f*, is the position and place of the tongue *t u*.

It is remarked, that when the implement is made use of for sowing turnips, the large hopper is taken off, and a set of small ones fixed upon the same oval cavities at the end of the brass cylinders. The quantity of seed is regulated by a tongue that screws up or down, as may be necessary.

An improved drill for this sort of seed is in use in Berwickshire, which drills two rows at a time, with much exactness and convenience.

Other sorts of drills, of the barrow or wheeling kind, have been recommended, but they are much less applicable for this purpose, than those that have been described.

At *fig*. 5. is shown a machine of this sort invented by Mr. Knight, of Shropshire, in which *a* is the iron wheel running on the edge, formed by two concave sides, which makes the groove for the seed; *b*, a wheel moving on the same axis with the former, and turning the wheel *c* by a strap, which gives out the seed. By having different sizes of wheels, more or less seed is sown, as they increase or diminish the rapidity of *c d*, the tube through which the seed passes into the channel formed by the iron wheel; *e*, feet of the machine; *f*, six lengths of jack-chain for covering the seed; *g*, the seed-box; *h h*, the handles. There are two holes before the axis of the great wheel, for moving two pieces of cane, which mark the proper width of the intervals between the rows. The angle on the edge of the wheel, and the weight of the implement, are more or less acute and heavy, according to the strength of the land.

There are a great many other implements of the drill-kind, but which it is unnecessary to have representations of, in this part of the work, as they will be described in speaking of the crops for which they are more particularly made use of.

Drill-*Rake*, an instrument invented by M. Vanduffel, for drilling peas and similar sorts of seeds.

It is chiefly calculated for light grounds, in small inclosures, not exceeding four or five acres. It is a sort of strong plough-rake, with four large teeth, as shown at *a a*, *b b*, *fig*. 6. *pl*. XXXI. a little incurvated. The distance from *a* to *a*, and *b* to *b*, is nine inches. The space, or interval, between the two inner teeth, *a* and *b*, is three feet six inches, which is sufficient room for the cultivator or hoe-plough to move in, if conducted with care, before the peas have branched much. To the piece of timber, *c c*, forming the head of the rake, are fixed the handles, *d*, and the beam, *c*, to which the horse is fastened.

It is evident, that when this instrument is drawn over a piece of land made thoroughly fine, and the man who holds it bears upon the handles more or less according to his discretion, four channels or small furrows, *f*, *g*, *h*, *i*, will be formed; that the distance between the furrows, *h i*, and *f g*, will be nine inches; and that the interval, *e*, or space contained between the furrows *g h*, will be three feet and a half. It is also evident, that these distances may be preserved with great truth, provided the teeth *a a* return (when the ploughman comes back, after having ploughed one turn, or bout, as they call it) in two of the channels formed before, marked *b b*; so that though he cuts four drills at the first bout, yet, in effect, he only forms two drills each turn afterwards, because there are always two drills to be passed over twice, or re-ploughed, being, in fact, not much more than guides or marks of direction. But even this double work repays itself, because it makes the drills more open, distinct, and clear. If the first four channels, formed at one motion by this instrument, are straight and true, all the lines in the field will partake of the same regularity. It will

therefore be proper to mark out this first trace of the drill-rake by exact measurement, fixing into the ground, at every distance of ten feet, little flat sticks, labelled with paper; which being finished, the rest may be left to the ploughman.

When the ground-plot of an acre is thus formed into drills (which may be completed in four hours, by one ploughman, a horse, and a boy to lead the horse), two or three women and children must be sent into the field, in order to sprain or scatter the pease by a single motion of the hand, at a certain distance one from another, into the channels. Use no harrow, which will be apt to draw the seeds out of the lines; but cover them with the flat part of the head of a hand-rake, and press them down gently.

The excellence of this drill-rake consists in its simplicity; for after the measurement of the parts is once laid down, any common carpenter and smith can either make or repair it: and, if the first four inches formed by it are true, the rest of the lines or rows must be geometrically exact, which is an elegance none can feel, but such as take delight in correct husbandry.

Drill-*Roller*, a roller so contrived as to form regular small incisions or drills in the ground at proper depths for the seed. It was probably invented in Norfolk: and is merely a common roller mostly of iron, about seven feet long, about which are put cutting-wheels of cast iron, that turn round the common cylinder, each independently of the others, which cylinder generally weighs about a ton. It is drawn by three or four horses abreast, and driven by a man elevated behind them; the cutting-wheels being moveable, may be fixed at any distance, by means of washers; but the most common and favourite distance is four or six inches.

It has been found effectually productive of the principal benefits which have been derived from the operation of drill-ploughs, or the practice of dibbling and setting the corn by hand, with the great advantage of saving both time and expense; as, by the use of this simple machine, one man may sow and cover five or six acres of corn in one day, using for the purpose three horses, on account of its weight. It was at first chiefly used on clover or other grass-lays on the first ploughing, but may be as properly employed on land which has been three or four times ploughed.

The mode of working it is this: a layer or other ground being ploughed, which the owner intends for setting or dibbling, this kind of roller is used to save the expense. It is drawn across the furrows, and cuts the whole field into little drills, four inches asunder; the seed is then sown broadcast in the common quantity, and the land bush-harrowed; by which means the seed is deposited at one equal depth, as in drilling, and that depth a better one than in setting, and the crop rises free from the furrow-seams, which are the ill effects of common broadcast sowing, at least on a lay, ploughed once. A representation and full description of it are given in the plate on rollers. See *Roller*.

The length of the roller may be more or less, according to the choice of the owner: and the ribs of it may be also deep or shallow, so as to determine the depth of the drills, and the distances of the rows, by the same rule. The common length is about eight feet; and if eight-inch distances, for instance, should be thought most proper, then the roller would have twelve ribs. The common diameter is about twelve inches. It is almost unnecessary to remark, that the soils on which this implement can be used to the greatest advantage must be light ones, and the surfaces even, and well pulverized.

DRINKING-*Cistern*, a tank or trough contrived for the purpose of holding water for cattle to drink at. It is observed, by Mr. Marshall, in the Rural Economy of the Midland Counties, that in an open yard belonging to one of the first managers of the district, he saw a drinking-cistern on an admirable plan. It was formed by a water-tight wall, raised high enough above ground to prevent the cattle from stepping into it, and low enough to let them drink freely. The brick-work, which formed a cistern about four feet square, was guarded by a post at each corner, with rails passing from post to post, over which rails the cattle drink. It is fed by a covered pipe (of pipe-bricks) reaching to a large drinking-pool, at some distance from the yard; so that while this is full (which it is in winter) the cistern is so likewise to the brim. If it overflow, (which it generally does at that season) a waste-water pipe conveys the surplus out of the yard. Cisterns of this kind, when they can be formed at an easy expense, are much preferable to pits in farm-yards: but when fed by ponds in this manner, no cattle should ever be suffered to go into them, as it is of much advantage to have the water as pure as possible.

Drinking-*Pond*, that sort of pit or pond which is employed for the purpose of watering cattle or other animals at. See *Pond*.

Drinking-*Pool*, a pit dug out for the purpose of supplying cattle with pure water. It is remarked by Mr. Marshall, in the Rural Economy of Norfolk, that in that county there are three species of artificial drinking-places; *Standing-pools*, *Artificial-rills*, and *Field-wells*.

The standing-pools are, he says, formed by an art which ranks among the most useful in Rural Economy. In many high situations, no other expedient can be practised with propriety: rills cannot be raised, nor wells sunk and worked, but at too great an expense for the purpose of watering stock. On the hills of Surry and Kent, ponds are made to hold water tolerably well with chalk beaten firmly together. But experiments have, it is said, been tried with chalk upon the Yorkshire Wolds without success; owing, probably, to the too great hardness of the wold-chalk. A fat soft chalk is no doubt fittest for this purpose. In Norfolk, he apprehends, they have been formerly made with marl. In all countries where unfathomed beds of clay are common, drinking-pools sufficiently retentive may,

at a small expense and without much art, be formed, and are in general sufficiently abundant. But the art of making retentive pools with clay, in loose absorbent soils, is, he says, a recent discovery which has been hit upon in this district; in which it has made a rapid progress, and is now in universal practice among farmers of every class. Indeed, says he, for a country like this, where upland soil is kept principally in grass, it may well be considered as a most valuable discovery.

This art chiefly consists in having the clay for the sides or banks of a sufficiently tenacious quality, and sufficiently trodden or puddled in making them up, and in ramming the clayey and other materials well in behind, so that the water cannot in the least penetrate; as where that is in the smallest degree the case, it soon undermines and throws them down, as well as lets out the water. And Mr. Billingsley, in the Report of Somersetshire, in speaking of farms on the Mendip Hills, observes that the next, and not the least important appendage of these farms, are *pools* or *reservoirs of water*; for on hills so elevated few springs can be expected. Nothing, he thinks, more strongly verifies the truth of the old adage—'Necessity is the mother of invention'—than the skill exhibited by the masons of this district in buildings of this nature. Scarcely ever do these pools, says he, let through the water, and the cost, supposing a pool to be of the following dimensions, 40 feet long, 16 wide, and 6 feet deep in the middle, may be thus stated:

Digging out for foundation, which in most instances will furnish a sufficient quantity of stone for the building - -	£.2	2	0
Mason's labour - -	10	10	0
Three hundred bushels of lime -	3	0	0
Ten loads of clay, and carriage	1	0	0
Eight loads of coal-ashes and carriage - -	1	8	0
	£.18	0	0

It is remarked, that some cautious people go to a considerable distance for lime made from the white-lyas stone, which is certainly a stronger cement under water than the lime burnt on these hills. In this case, an additional expense is incurred.

A pool of these dimensions, he says, if properly situated, will supply eighty or one hundred acres with a sufficiency of water for the stock throughout the year; and, if well made, may be kept in repair for six-pence a year. See *Reservoir* and *Pond.*

DROKE, a provincial word used for darnel.

DRONE, the male bee, one that makes no honey. See *Bee.*

DROPSY, in *farriery*, a disease incident to horses, and generally, though absurdly, called water-farcy. See *Water-farcy.*

DROPWORT, the name of a perennial weed common in pasture-lands, having winged leaves; the divisions of which are all regular, and sharply indented about the edges. The flowers are white, growing in a bunch like an umbel. Its roots are very remarkable, consisting of a bunch of knobs hanging upon threads; from whence it has the name of filipendula, and dropwort. The flowers have an agreeable smell.

DROUGHT, the effect of long-continued dry weather, or the want of rain: when applied to animals, it signifies thirst, or want of drink.

DRUDGE, an implement of the rake or harrow kind, peculiar to West-Devonshire. It is a sort of long heavy wooden-toothed rake, the teeth being broad and placed with the broad or flat side foremost. It is drawn by horses or oxen, and made use of to collect the broken parts or fragments of the sward, which have been broken or loosened by the operation of the plough and harrow, in order to their being burnt in the manner practised in sod-burning, or paring and burning.

DRUG, a term provincially applied to a four-wheeled timber-carriage.

DUB, a provincial term applied to a small pool, or hollow, containing water.

DUCK, the name of a well-known water-fowl, which may frequently be kept to advantage by the farmer. Ducks live on snails, worms, corn, &c. but require to be much in the water. At the proper season they lay a great number of eggs, especially that sort of duck which turns up its bill rather more than the common kind. When they sit, no attendance is requisite, except it be to let them have a little barley or offal corn near them, that they may not straggle far from their nests, and thereby chill their eggs. It has been supposed that they are rather better hatched under a hen than a duck; because while they are young, the hen will not lead them so often into the water; but it is obvious that the habits of the hen are by no means suited to the rearing of such kinds of birds. And the common practice of cutting off the feathers from the tails and rumps, because when they are wet it is supposed often to occasion their drowning, is probably founded on little better authority. In the fattening of them, care must be taken that they are well and regularly supplied with grain, be kept from light, and have plenty of water. Oatmeal, when wetted either with milk or water, is a very good substance for feeding them with. See *Poultry.*

DUN, a colour partaking of brown and black, frequent in horses.

DUNG, the excrements of animals, and also such putrefied vegetable substances as are used in improving land. This is the most common, and, upon the whole, the most efficacious of all manures. It is supposed to promote vegetation in various ways, as by increasing the quantity of vegetable food in soils, by enlarging the pasture of plants, by communicating to them a power of attracting the vegetable food from the air, and by contributing to the preparation of the food for the nourishment of plants.

The dung of quadrupeds is by much the most common manure in use.

Stable-dung is used either in a fresh or putrefied state; the first is called long, the second short dung.

It abounds in animal matter, easily putrefies, and serves to hasten the decay of other dead vegetable substances. Its fermentation is promoted by frequent turning and exposure to the air: yet it should be covered, to prevent water from carrying off most of its important ingredients; or at least the water that imbibes them should not be lost.

Night-soil or human ordure is a very highly animalised and rich sort of dung.

Farm-yard dung consists of various vegetables, chiefly straw, sometimes weeds, leaves, fern, &c. impregnated with animal matter: it ferments more slowly than stable-dung, should be piled in heaps, and stirred from time to time: fern in particular putrefies very slowly. In order to promote the making of this sort of dung after the old is removed, the farm-yard should every season be fresh covered to the depth of a foot or two with good rich earth, the scouring of roads or ditches, chalk, marl, or other similar substances, as a foundation or bed for the reception of the urine and moisture that may come upon it, by which the quantity of manure is greatly increased.

Where any considerable quantity of stable or yard-dung, or other mixture of animal and vegetable substances, is collected together in a heap, and fermented; when the process is completed, if the mass be examined, we find that the vegetables of which it was originally compounded are decomposed, and in a situation to nourish new plants. The more completely therefore these substances are submitted to the process of fermentation, the more beneficial will be their effects upon the soil. Hence it is an object of the first importance to farmers to have the dungstead so situated and constructed as to promote their fermentation, and retain all the useful parts which they contain. These circumstances have been but little attended to; the greater part of dung-heaps being either placed in hollows, and surrounded with water, which effectually prevents fermentation, by chilling them; or upon declivities, where every drop of moisture runs away: cattle are allowed to spread it by trampling, weeds to exhaust it, and carts and waggons are driven over it. Thus the middle, from being hard pressed, will be imperfectly fermented; and the sides, from being scattered about and dried, will not be fermented at all, but in a condition little better than dry straw. To promote fermentation in dung, air and moisture are necessary. It is well known to gardeners, that in making hot-beds, by laying the dung lightly in heaps, and watering it gently, fermentation is immediately brought on; and that hot-bed dung is as completely fermented in a fortnight as that in a farm-yard generally is in six or eight months. The farmer should therefore imitate this practice as nearly as the nature of his situation will admit; and instead of having his dung placed in the yard, and allowing carts, cattle, &c. to disturb it, he should place it in some distinct situation, convenient for his offices, where the urine may be kept with it, or else run into a receptacle, whence it may be thrown back upon the dung to enrich it and promote the fermentation, or be carried off in carts to manure his land. When dung is carried to the dung-heap, it should not be driven over the heap as is commonly practised, because the feet of the horses and the weight of the carriage will press it so hard as to exclude the air, and thereby prevent fermentation: when the quantity also is considerable, the horses are strained, and the harness damaged by the exertions necessary to drag a loaded carriage over a hill of such loose materials. Every load therefore ought to be laid down by the side of the dung-heap, at least after the work has made such progress as to render passing over it a matter of difficulty, and afterwards thrown up lightly with a fork; the labour of which is trifling in comparison with the advantage resulting from it. If dung laid up in this manner contains a sufficient proportion of moisture, it will immediately begin to ferment; if therefore it is too dry, it should be watered, and in summer this will frequently be found necessary: it will thus be completely fermented in six or seven weeks, and will be more valuable by half than that which is made in the common slovenly manner. The situation best calculated for a dung-heap is that which is nearest to a level, with a bottom capable of retaining moisture, and covered with a shed: and if the whole be inclosed with a wall, except an open space at one end for carting away the dung, it will be a great improvement. The wall on the south side should be of such a height as entirely to prevent the sun's rays from reaching the dung; on the other three sides, six feet in height from the ground, will be sufficient. The roof may be thatched, and supported on pillars. If the bottom be not clay or chalk naturally, it must be laid with one of those substances, and the upper part should be paved with broad flags or common paving stones. At the end opposite to the opening, a reservoir may be dug to receive the moisture: it should be water-tight, and a pump should be put into it to draw off the moisture daily. This may be thrown back on the dung-heap, or drawn into a barrel on a cart, and either spread immediately on the land, or mixed with other substances in the form of a compost manure.

In the application of dung to land, various circumstances are to be attended to, in order to adapt it to the nature of the different soils. Such as is the most animalised, and the most disposed to fermentation, is probably the best suited to the colder and more stiff kinds of soil; while those that are of the more vegetable nature, and but little inclined to ferment, may be the most proper for the lighter sorts of land. Dung is, however, applied almost indiscriminately upon all soils and at almost any season, and for every sort of crop. Of all manures commonly in use, none can be considered as a more immediate food for plants; and when applied to vegetables in a growing state, they immediately begin to thrive. On this theory it seems absurd that great quantities of rich dung should be laid upon the fallows at the end of autumn, and still worse about midsummer, there to remain till the ensuing spring before it can be of any use to the plants: for if the

fallow be sown with wheat or any other winter crop, the growth of the plants being stationary, they need little nourishment; in the mean time the nutrient particles contained in the dung, after having been spread abroad a month, or perhaps six weeks, are readily dissipated and carried off by the effects of heat or the winter rains; and when the spring arrives, and the plants begin to vegetate, a great part of what was destined for their nourishment has been washed away, exhaled, and lost. Farther, where fallows have been well wrought, and the soil thus completely reduced, mixing it with dung in that state prevents it from acquiring a sufficient degree of compactness to shelter the roots of the plants, especially if the soil be naturally of a light open texture, and the dung full of a half-rotted straw, as is commonly the case. The operation of the winter's frost renders it still looser, so that in spring it is nearly in the state of a mole-hill; the baneful effects of which to a wheat-crop are obvious. Now were a portion at least of the dung withheld till the spring, the land would be more compact, the plants less liable to be thrown out of the ground by the frost, and the dung being applied as a top-dressing at the time when vegetation was commencing, the useful parts of the dung would be taken up by the plants every time it was moistened, as the crop in its progressive growth most wanted it. In this mode of application no part of the dung would be lost; and a less quantity being required for the dressing, three times the quantity of land might be dressed annually, and applied in a quantity sufficient only for the nourishment of the crop.

Some agricultors are of opinion that the first rank quality of dung is highly beneficial, and constitutes its principal virtue: but Mr. Belcher, on the contrary, is inclined to think that it is more or less injurious—greatly so in horse-dung, which is evidently unfit for plants when new. In his opinion, the best mode of using all dung, except in compost, on cold stiff ground especially, is to carry it on rough, and to fallow that and the soil together, whereby, at the same time that they are incorporated, the seeds of weeds are forced into vegetation, and completely destroyed.

The common mode of practice is to set the dung upon the land in small heaps or hillocks, and to spread it by a man standing on the ground. But in some of the midland counties the prevailing custom is to spread it out of the carriage, as it is brought into the field, by a man or men standing in the carriage. The former is obviously the better practice. Dung should scarcely ever be moved in summer, as the immediate action of the sun's rays exhausts it of its moisture; and it is an erroneous idea that this evaporation carries off merely aqueous particles; the mucilaginous and the oily matters rendered miscible with water by the alkaline, saline, or calcareous earth, and the inflammable air, are all dissipated with the water. To turn a dunghill over, then to throw it into carts, expose it in heaps, and to spread it a second time in summer, is to give the sun a power of nearly exhausting its virtues. However, a Hertfordshire farmer, on the contrary, never carries dung out by choice in winter, thinking that the rains, &c. damage it much; but in summer he does not think its being exposed to the sun a detriment, supposing the heat to exhale only the watery particles. He has found one load laid on at Midsummer as good as two or three at Christmas. The fresher the dung is used, the better he also thinks it for any crop, even for grass, provided it be laid on early in autumn. He has found long dung of only one or two months old to be better, load for load, than black spit-dung for turnips. In forming a dungheap, he says, the dung will not rot if the carts drive on to it; but if the dung be shot out of the carts by the side of the hill, and then thrown up, without any trampling, it will rot much sooner and better. This is also the practice generally adopted in Norfolk. But at whatever time the dung is carried on the land, it should be spread and ploughed in as soon as possible. It is said to be a wrong practice to lay dung upon clover-leys in autumn: for if the field be to remain another year in grass, not only a part of the dung is washed away by the winter rains, but the remainder injures the plants; it being well ascertained that the action of dung upon broad clover, when the plants are not in a growing state, is fatal to them. But in the spring a light top-dressing of dung is highly useful to broad clover, though soot is preferable. If the clover-ley is to be ploughed for wheat, and dung be laid on, when the grass-crop has been good, the furrow will be turned over entire, and the dung laid flat under it; and as the roots of the wheat must penetrate through the sod before it can reach the dung, little benefit can be expected from it, allowing the qualities of the dung to remain unimpaired: but in this case the loss from the winter rains will be greater than when dung is laid on fallow; for these being incorporated with the soil, a part of the nutrient properties will be entangled with the earth; but upon ley, it is either laid in the bottom of the furrow, or, if the sod be set on edge, it remains crammed into the interspaces through which the whole of the rain passes. Whenever wheat therefore is sown upon ley, the dung ought to be used as a top-dressing in the spring, in which case every part of the crop will have the benefit of it; and the harrows having loosened the top of the furrow, so that the moisture of the dung will readily enter it, no part of the dung will be lost. If the ley is to be ploughed for oats, provided the land was well laid down, there is no occasion for dung; but if the land be poor, and dung is required, it cannot be employed in any way so usefully as in the form of a top-dressing at the time when the seed is sown. Perhaps there is no way in which dung is used where its effects are so certain and visible as upon potatoes and turnips. For potatoes, it is laid on when the spring is pretty far advanced, after which there are few heavy rains, of course the strength of the dung is not impaired by washing, and the crop is left in quiet possession of the whole of its fertilizing powers. For turnips, the case is nearly the same; indeed the advantage

is still greater, dung not being laid upon turnip-land sooner than June, after which there is seldom much wet weather till autumn, and by that time the crop is in full vigour.

In the laying dung upon meadows or grass-lands, farmers differ in opinion; some preferring the spring for producing an early vegetation and a plentiful crop: others thinking that though dressings of soot and fine ashes at that season are of much use, yet that dung ought to be laid on at the end of autumn, not to taint the juices of the ensuing crop. It is thought to be a good practice by some to spread the dung as soon as the hay is cleared. If laid on in the winter, or early in the spring, the frost will take effect upon the manure before the grass can reap any advantage; and the rains coming whilst the manure is exposed on the surface, washes away its virtues before vegetation is awakened by the sun. But in July, if there be any showers, the quick growth of the after-grass will shelter and protect the manure; and nothing is to be feared but a severe drought. In this case, however, this after-growth should be left through winter, to be fed in the spring, when the value of such seed will be great, and the dung, by means of such a covering, will be guarded against the frost in the best possible manner. Mr. Miller, however, reprobates the dressing of grass-ground in summer, soon after the crop of hay is taken off the land; because, before Michaelmas, the sun, he thinks, will have exhaled most of the goodness, if the dressing be of dung, or any other soft manure.

Distinctions are frequently made by farmers in respect to dung of different animals. Horse-dung, from its great disposition to fermentation, is well suited for the purposes of the gardener, and for the colder sorts of land: indeed, Mr. Miller says he has frequently seen new horse-dung buried as it came from the stable in very cold moist land, and always observed that the crops succeeded better than where the ground was dressed with very rotten dung.

Sheep's-dung and deer's-dung are nearly of the same quality, and are generally esteemed the best of all dungs for cold clays. Some recommend beating them into powder, and spreading them very thin over autumn or spring-crops, about four or five bushels to an acre, in the same manner as ashes, malt-dust, &c. are strewed. But this light dressing does not last long. The most common way of conveying the former upon the land is by folding of the sheep themselves upon it, by which means their urine is saved as well as their dung, which ought to be turned in with the plough as soon as possible, that it may not lie exposed to the heat of the sun. In Northamptonshire, they think it best to fold sheep after July, and to fold them the latest upon dry land. In some parts of France, where they likewise fold their cows and oxen, the place of folding is changed twice every night. In Flanders, they house their sheep at night in places spread with clean sand, about five or six inches thick, which being laid on fresh every night, is cleared out once a week. This mixture of sand and dung makes an excellent dressing for strong land; for the dung and urine of the sheep is a very rich manure. M. Quintinie thinks it the greatest promoter of fruitfulness in all sorts of ground. This method of folding sheep in a covered fold, and of mixing their dung with earth, sand, &c. according to the nature of the soil it is intended for, is likewise very properly recommended by Mr. Mortimer; who adds, that he has known vast crops of rye upon barren lands that have been old warrens, well dunged by rabbits; and large oak and ash upon the same, though the soil was very shallow.

Next to sheep's-dung, the preference is generally given to that of swine, one load of which, it is said, will go as far as two loads of other dung. The laying it on two thick may perhaps have occasioned the old mistaken notion of its breeding more weeds than any other dung: for all dungs will make weeds shoot up, whether they contain within themselves seed, of those plants, not so thoroughly digested by the animal as to be deprived of their vegetative power, as may sometimes be the case, or by the additional fertility which they communicate to the earth. This dung, according to some accounts, is best when carried from the stye directly to the field, where it is a rich manure both for corn and grass, especially the latter, and for almost any sort of land. Hot sands and gravels are particularly benefited by it; and it is reckoned a very great fertiliser of fruit-trees. Many good husbandmen prefer this dung before most ordinary sorts of manure, and take great care not only to have their hog-yards well paled and paved with pebble, or other stones, or with chalk, which is much the best; but also to increase the quantity of the dung as much as they can, by throwing into the stye all the straw, fruit, roots, beans, plants, weeds, &c. which are the refuse of the garden, with the offals of the kitchen, and every kind of trash; all which is not only very good for the hogs themselves, but increases their dung to such a degree, that ten or twelve swine have yielded sixty or eighty loads of excellent manure in a year. Some notable farmers too will make their hog-yard produce them an annual profit of twenty or thirty pounds. Mr. Worlidge thinks this the best kind of dung to prevent or cure the canker in trees: and Mr. Mortimer esteems it best for manure, when mixed with horse-dung; for which he advises placing the hog-stye as near the horse-dunghill as can conveniently be. The farmers in Staffordshire frequently sow, on poor, light, shallow land, a small white pea, which they never reap, but turn in as many hogs as they think the crop will fatten, and let them lie upon it day and night. The dung and urine of these animals enrich the land so much, that it soon acquires a thick sward, and continues to be good grazing-ground for several years. Such a practice is not however to be adopted, except in particular cases.

Human ordure is also a very rich and fertilising manure, and therefore extremely proper for all cold sour soils, especially if it be mixed with other dung, straw, saw-dust, or earth, to give it a fermentation,

and render it convenient for carriage. Some do not like to use it on account of its bad smell; and others imagine that it gives a fœtid taste to plants; but in this they seem to carry their delicacy rather too far. It is used with great success in many parts of France, all over Flanders, and in China.

Dr. Hunter affirms, that it is the richest manure that can be introduced into the field; that in Flanders they use it with great success, either strewed upon the land in the form of powder, or dissolved in water and thrown on with a wooden scoop; but that it may be best prepared as a top-dressing by filling the pits of necessaries with earth or lime.

In China and Japan, wonderful attention is paid to saving this manure, which in these countries is preferred to all others, both on account of its richness, and its being free from weeds: insomuch that Chevalier Thunberg, the famous botanist, passing through Japan with the Dutch embassy, scarcely found any other plants in the corn-fields but the corn itself. In those countries the laws prohibit the waste of human excrement, and every house has reservoirs for it, to the great annoyance of the traveller through their towns. Mr. Young has found the effect of night-soil (from 160 to 320 bushels on an acre) prodigious, trebling the produce on land unmanured; and he asserts, that in all the experiments he has made with this manure, he has found the result almost uniform. In a meadow lately laid down, and in very poor condition, two acres of the worst part being covered after hay-time with four waggon-loads of night-soil, unmixed with any thing, and spread directly, the herbage thickened surprisingly, and grew most luxuriantly. The cattle, neglecting the rest of the field, were perpetually feeding on this part; so that by autumn it was pared down like a fine green lawn, the other part being a dusky, rough, ragged pasture. The part of the field manured with night-soil continued excellent. Mr. Middleton has likewise found it an extremely fertilising manure, but not so durable as some other kinds. It is therefore wonderful that this manure has been so neglected, and so much of it suffered to run to waste and be lost.

Lime thrown into privies makes an excellent mixture with the excrement, and at the same time takes off the ill smell and noxious vapours of it. Saw-dust, peat-moss, or any common earth, is likewise highly useful in absorbing the urine. Lime will also render the excrement so short and dry, that it may be used as a top-dressing. Two cart-loads of ordure mixed with ten loads of earth, and one of lime, is a sufficient top-dressing for an acre, and is excellent upon light lands for wheat or barley: for the former of which it should be used early in the spring; and for the latter it may be either scattered upon the young crop, or harrowed in with the seed. It is particularly convenient for all crops of the drill kind.

The dung of all sorts of poultry is of a very rich nature, and therefore extremely proper for cold lands, being light of carriage, and a little of it going a great way. It is most commonly used for distant grounds, where it is sprinkled on wheat or barley, after they are come up, or upon the latter at the time of sowing. Mr. Mortimer thinks forty bushels sufficient for an acre. It is said to be used to most advantage when dried and powdered. Its effects are sudden, but they do not last long; it must, therefore, frequently be renewed. Hen's-dung is very rich, though not so fertilising as pigeon's-dung; nor is it so easy to sow, because it hangs more together, neither can it be so easily collected. The opinion that goose-dung is rather hurtful than beneficial to corn or grass is, probably, an error. This sort of dung is the most beneficial on the deep stiff sorts of land.

DUNG-*Hills*, heaps of manure collected in the yard or other places belonging to a farm. They are, mostly, made up of the dung of different animals, of different kinds of straw, and other vegetable substances; and they have frequently different animal substances in their compositions.

They should be placed on an even situation, and formed in the manner described above. Although it is mostly the custom with farmers to collect manure of every description into one heap, from which substances very opposite in their nature, and which may be wanted at different times and for different purposes, are laid together, and, instead of forming a useful combination, perhaps prevent the dung from fermenting as it ought: every farmer should have at least two or three dung-hills, to be prepared for use, according to the time at which the contents of each may be wanted, and the articles of which they are respectively composed.

Where earth, peat, moss, shovelings of highways, or such like substances, can be procured, the bottoms of dung-hills, when composed of rank stable-dung, or short excremental dung, should always be laid three or four feet deep with them. This will increase the quantity of manure; for the moisture that is forced out during the fermentation will sink into the earth, &c. and impregnate it with its properties; and, if the whole be afterwards turned and incorporated, what was laid in the bottom will be found of nearly equal value with the dung itself; and by such means no waste would be sustained.

Compost DUNG-*Hills*, collections of different matters, as earth, mixed with dung from ordinary dung-hills, lime, and other manure. Some farmers make dung-hills of this kind, and are of opinion, that the dung and other manures with which they are compounded are thereby made to enrich a greater quantity of land than if not mixed with earth; and besides, do not produce the bad effects which sometimes are produced by dung, when taken directly from a dung-hill and laid upon land.

Lime, as it is found to dissolve all vegetable and animal substances, when mixed with dung, must help to resolve it; and as it communicates an absorbent power to earth, may enable the earth with which it is mixed to attract the vegetable food more plentifully from the air. But in order to make it produce these effects, it is necessary to mix it with dung and earth: for if the lime is laid in a kind of

stratum above the dung, and below the earth, it will absorb the water that falls upon the dung-hill, and thereby will prevent the dung from receiving a sufficient quantity of water to make it putrefy; and will also occasion such a heat as to burn the dung, and render it useless; and besides, can have but little influence in dissolving the dung, and communicating to the earth its absorbent quality. If the lime is laid above the earth, and exposed to the air, it will be attended with the same consequences: it will absorb the water; and though it may attract vegetable food from the air, yet will be of no more use for this end than if spread upon as much land as the surface of the dung-heap extends to.

The same thing may be observed of marl, when used instead of lime; but if used instead of earth, it is probable that the compost may become very rich, on account of the strong absorbent quality which it possesses, being greatly exposed to the influence of the air. A smaller quantity than is used in the ordinary way would, probably, in most cases be found sufficient. The dung may be incorporated with the marl to the most advantage at the place where it is obtained.

The advantage of making compost dung-hills, by mixing dung with the earth, is, in many cases, more beneficial than lime. The dung, in ordinary dung-hills, is liable to have its virtues sometimes washed away by rain, when it falls in large quantities; but this is effectually prevented by the earth in the compound dung-hill, which absorbs the water and all the vegetable food which it carries down from the dung. And in the ordinary dung-hills, too, the dung on the surface is apt to lose a part of its vegetable food, by being exhaled by the sun, or carried off by the wind; but this is prevented by covering the dung with earth in the compound dung-hill.

It has been commonly supposed, that the compound dung-hill received its principal advantage from the earth being exposed to the influence of the air, and, therefore, that the more absorbent the earth is which is used, and the larger the surface of the dung-hill is, in proportion to its bulk, the richer the quantity of dung contained in it will be: this led to the method of constructing them long and narrow, with as many divisions as can be made conveniently; as thereby a larger surface is exposed in the same quantity, and more vegetable food supposed to be acquired. Mr. Marshall recommends compost dung-hills to be made not less than fourteen, nor more than eighteen feet wide, as this size will admit room for two men working behind, and one on each side, in filling the carts. If it is narrower, the men at the wheels have not sufficient employment; if it is wider, they have too much, nor can they reach the cart without moving their feet and making a step, which takes up as much time as throwing in a shovelful of compost. The sides of a dung-hill, he thinks, should not be upright, nor too high, that the men may stand conveniently to fill. Perhaps, he says, one rod wide, and a quarter of a rod high, when settled, may be the best form of a compost dung-hill.

But it is obvious, that besides the influence of the atmosphere, the various matters which are thrown off and formed during the progressive decomposition of the dung in the heap or compost may have considerable effect on the earthy materials, and on that account earth should always be placed in the bottoms of such dung-hills, to receive the juices of the dung which may be carried down, and that a covering of it should be applied over it to prevent them from being exhaled or carried off; the earth exposed for a considerable time, before more dung is laid on, that it may receive all the benefit from the air which it is capable of, previously to another addition being made.

Compost dung-hills are made with least expense upon the field for which they are intended. The head-ridges are commonly high raised, by the turning of the ploughs upon them, and contain the richest earth in the field; however, they are very proper for forming the dung-hills upon, as the earth is at hand, and can easily be thrown upon the dung.

In forming dung-hills of this kind, earth as opposite as possible to the nature of the soil upon which the dung is to be laid, as well as clay, has been supposed the best for a light soil, and light earth for a clay soil. But besides this, the nature of the dung, and that of the properties of the matters which may be formed from it, should be attended to, in order that the best effects may be produced.

In respect to the mode of mixing and preparing compost dung-hills, it is frequently recommended, and commonly practised, by farmers, to place the several materials in layers, six or eight inches, and sometimes a foot thick: but when they are laid so thick, especially if they be clay or strong earths, the fermentation in the compost is seldom strong enough to penetrate them sufficiently; from which circumstance, when the compost is turned over, these layers come out whole nearly as they are laid in; they receive but little benefit by the fermentation, and require almost as much labour to break and mix them as they would have done at first. It is therefore much the best way to break the strong earthy and other materials at first, and to employ several labourers to throw them upon the compost-heap in such manner as at first to mix them well. By this method a fermentation quickly commences, the whole is intimately mixed and incorporated; so that much less turning than common is required, and the compost is ready for use in a much shorter time. Besides, it comes out of the heap in such a condition as farmers desire, that is, it is mellow and crumbly, and fit to spread equally upon the land.

In making compost dung-hills, some, however, think the best method is for the farmer to get all the various articles of manure he can possibly procure, the richer the better; after which the different ingredients should be as equally mixed and blended

as possible; but that lime or caustic-ashes should be placed in union with the earthy or vegetable matter. Every practical man knows how and when to turn over the heap, and to divide and break down such lumps and clods as may be met with; but this ought never to be done so as to impede fermentation, while that process is going on; as this business ought always to be well performed on first making the heap. In forming a compost of slop or liquid materials, the author of the New Farmer's Calendar observes the following is a good method:—First raise a sort of earthen wall, with a lining of the same; the bottom part and sides being of sufficient thickness, and the latter of sufficient height to contain the various ingredients. In making them in this way, the carts, by being backed to the sides of the walls, may discharge their contents, such as mud, scourings of ditches, ordure, weeds, flags, and such like matters into them; a suitable quantity of lime being then added, and the whole inclosed by a covering of good mould. Composts of this nature, after some time, cut up very rich; and after being stirred over, may be frequently again covered with a small quantity of earth or mould, by which good manure is speedily formed. See *Manure* and *Compost.*

DURZ'D-OUT, a term applied in some counties to corn beaten out of the ears in the field by the wind or other accidents.

DWARF-OAK, the name of a shrub, sometimes employed for making live fences. It grows very fast, and becomes so thick by cutting with sheers, that hardly a bird can creep through it when in full perfection. In making a hedge with it, the acorns are sown in rows or drills, where it is proposed to be, by which a fence of considerable height may be formed; and which, in exposed situations, may serve as a screen.

DWINED, a term used to signify shrivelled, as corn.

DYDLE, a term provincially applied to a kind of mud-drag.

DYCHE, a term signifying ditch. See *Ditch.*

DYER'S-WEED. See *Weld.*

DYKE, a sort of wall or mound formed of earth or turfs, so placed as that each may bind and secure the joints of the other, somewhat in the manner that a good brick-wall is built. The ditches on the sides should be formed in a sloping direction, and the mould which is taken from them put behind the sods or turfs, in order to support them. Sometimes stones are put between the rows of turf, but this is not so good a method as having the whole of turf.

It is observed by Dr. Anderson, in comparing dykes with live hedges, that this kind of fence, if well built, preserves a field from the intrusion of domestic animals as effectually as any other, but that they afford little warmth or shelter to the field; whereas hedges, if good, answer all these purposes equally well. But that the most material distinction between dykes and hedges is, that dykes are in their highest degree of perfection as soon as they are reared, and from that moment begin to decay; whereas hedges, being at first weak and tender, stand in need of attention and care, and do not become a fence for several years after they are planted: but having once attained a due degree of strength, they gradually acquire a higher and higher degree of perfection.

Feal-DYKE, a mound or fence formed of the same sort of materials, and in the same way with that which has been just described.

Dr. Anderson supposes that fences of this sort will last a long time without needing any repairs, but that their durability must in a great measure depend upon the nature of the feal of which they are formed. The best is that which is taken from poor ground of a spungy quality, which is generally covered with a strong sward of coarse benty grass. In situations where this can be had, he has no hesitation in recommending this as the cheapest and best temporary fence that can be reared.

The greatest inconvenience, he says, that attends this species of fence is, the danger it runs of being torn down by the horns or wasted away by the rubbing of cattle upon it; which they will sometimes do, even where the ditches have been properly formed. This may, however, he thinks, be effectually prevented by planting a row of sweet-briar (eglantine) plants between the first and second, or, if the soil be fertile, and not in danger of being too much dried by the sun, between the fifth and sixth course of feal when the dyke is building, which, he thinks, will not fail to grow with luxuriance, and in a short time defend the dyke from every attempt of this kind. But if sheep are to be kept in the inclosures, this plant ought not, on any account, to be employed; for, as that defenceless animal naturally flies to the fences for shelter in stormy weather, the prickles of the straggling branches of the briar will catch hold of the wool, and tear it off in great quantities, to the great detriment of the flock, and loss of the proprietor. In these cases, if the possessor of the ground is not afraid of the bad consequences that may be dreaded from the spreading of *whins* (furze), it would be much better, he says, to scatter a few of the seeds of this plant along the ledget, at the foot of the dyke, which would quickly become a preservative for it, and be otherwise of use as a green food for his sheep during the winter season. But before he ventures to sow this plant, let him remember, that where it is once established, it will hardly fail to spread through the adjoining fields, and can scarcely ever afterwards be thoroughly rooted out. Where the soil is rich, white-thorn plants may be used in the place of eglantine, and will thrive remarkably well.

He has often imagined, too, that this kind of fence might be greatly improved, both in beauty and strength, by planting a row of ivy-plants beneath the first course of feal in building the dyke, which would in a short time climb up the sides of the dyke, and cover the whole with a close and beautiful net-work of woody fibres, covered with

leaves of the most beautiful verdure, which would tend to preserve the dyke from being eaten away by frost and other vicissitudes of weather; and, when it arrived at the top, it would there send out a number of strong woody branches, forming a sort of hedge that would afford some shelter to the fields, and break the force of the wind considerably; but as he has never had an opportunity of trying the experiment, he only offers it as a probable conjecture. He has found that in poor soils ivy will grow in this manner very well; but where the soil is rich, the grass is apt to choke it.

DYSENTERY, in *farriery*, is a violent purging, accompanied with blood in the fæcal discharges. See *Lax* and *Scouring*.

Where horses or other animals begin to purge, and continue but a short space of time with it, or when they are more than ordinarily open in the bowels, the disease is called a *lax*; but when it continues some time without any bloody discharge, they are said to scour, or to have a *scouring*.

When the disease is attended with discharges of bloody and slimy matter with the excrements, the disorder is of the dysenteric kind; but these symptoms seldom happen, except when the horse has been wounded in the intestines, or has received some uncommon treatment, such as violent and repeated *drastic* purges. It is seldom or ever the effect of diarrhœa. The reason that horses are not subject to dysentery, are, according to Gibson, in a great measure, their horizontal position, by which the rectum is not so apt to be affected in severe purgations as in man. The violent gripings, that are almost always the concomitants of a diarrhœa, also, he says, soon destroy the horse, if they are not removed; of course the disease seldom has time to arrive at the state of a dysentery or bloody flux. See *Diarrhœa* and *Looseness.*

E.

EADDISH, after-grass, roughings, or grass growing among the stubble, after the corn is cut.

EAR, the organ of hearing in animals. In a horse, the ears should be small, narrow, straight, and the substance of them thin and delicate. They should be placed on the very top of the head; and their points, when stiled or pricked up, be nearer than their roots. When a horse carries his ears pointed forwards, he is said to have a bold or brisk ear. In travelling, it is considered an advantage when the horse keeps them firm.

Ears *of Corn*, a term applied to the heads of different grain-crops.

EARING, a term probably used provincially for *aring*, which signifies ploughing, tilling, or cultivating land.

EARNING, provincially cheese-rennet.

EARTH, in agriculture, signifies the stratum or bed of mould in which vegetables take root and grow. It is constituted of different combinations of terrene materials. Earth, as it generally presents itself, is usually a mixture of the subsoil with various adventitious substances, either purposely brought to, or accidentally lodged or decomposed upon it. From these causes this superficial earth, commonly called mould, increases annually in depth; oftentimes to such a degree as even to form considerable eminences; especially where woods and trees, or any sort of coarse vegetable products, have undergone decomposition.

This *surface* or *vegetable* earth, and the natural under-turf earth, to the depth of about a foot, is generally the best and most fruitful, both on account of its containing much vegetable and animal substances, as well as from the influence which the atmosphere has had upon it.

The rest of the subjacent earths are to be estimated accordingly as they approach this in their qualities. Of these there are several kinds, distinguishable by their several constituent principles. The best of them is that which is black, fat, and at the same time porous; light and sufficiently tenacious, without any mixture of sand. It rises in pretty large pieces, and falls into a sort of powder of its own accord, after a short exposure to the air; but without crumbling altogether into dust, which is the defect of a less perfect sort. This sort of black earth or mould is fit for almost any purpose, without manure. But the farmer is not always so happy as to meet with it; or, if there be a small depth of it, other less fertile earths lie underneath, such as those of a clayey, gravelly, or sandy kind, which require different treatment, according to their different qualities. These earths often appear near the surface, and may be said to be almost barren, till brought by art to answer the purposes of vegetation. In clayey and stiff earths the component particles have too close an adhesion to admit the roots of plants with the ease requisite for them properly to seek their nourishment; and, on the other hand, sand and earths of a light nature are too loose to give the proper stability to plants, or to retain the moisture necessary to convey their nourishment into them. See *Mould* and *Soil*.

EARTH-*Board*, that part of a plough which turns over the earth. It is mostly termed mould-board. See *Plough*.

Earth-*Buildings*, a sort of pisé building. See *Rammed Earth Buildings*.

EATING-*Off*, a term employed by farmers to signify the feeding-off of different sorts of green crops at particular seasons, as turnips, &c. See *Wheat*.

EAVES, the edges of the roof of a building that over-hang the walls.

Eaves-*Gutters*, a small sort of troughs fitted up, and made use of to catch the rain-water that drops from the eaves or roofs of buildings. They are usually formed by nailing two narrow slips of board together; but when made in this manner are liable to warp, and become leaky in the joint at the bottom, the most essential part. They are much better when hollowed out of one triangular piece of wood, with a round mouthed adze. A piece of wood six or eight inches square, slit diagonally, affords two triangular pieces fit for this purpose. They are usually made of deal. Gutters thus formed are stiffer and more easily supported, less liable to warp, and much less subject to leak, than those made in the first manner.

EDDER, a small straight shoot of ash, hazle, oak, or any other kind of wood used for binding the tops of hedges.

EDDISH, the same with eaddish or after-grass. See *Eaddish*.

EDGE, the extremity or border of any thing.

Edge-*Grown*, come up uneven, not ripening all together.

Edge-*Hoeing*, the operation of hoeing the sides of the rows of any sorts of crops. See *Hoeing*.

EDIFICE, a fabric or building of any kind.

EFT, a newt, evet, or small kind of lizard, that chiefly lives in water.

EGG, the well-known produce of various animals of the bird-kind, as well as of various kinds of insects.

The eggs of birds in general are covered with a thin flexible skin, which is itself protected by a hard shell, consisting of calcareous matter, which differ in size, colour, and form, in each species; each variety, however, of the species preserving as constant an uniformity in regard to its egg through every individual as there is observed to take place among the individual animals themselves: but among the lesser orders of creatures, insects especially, which are, for the most part, oviparous, the eggs are usually covered only with a flexible film, and differ from those above described in several other particulars.

Though eggs may be formed, and gradually increase in magnitude till they attain their full size, and be as regularly excluded without the female having any communication with the male, yet the eggs thus produced, though they are to all appearance perfect, are, notwithstanding, found to be destitute of the principle of life, nor can any art ever make such eggs produce a living creature. But such eggs as have been duly perfected by the impregnation of the male contain the principle of life in them, though still in a dormant state. To call this into action, and, in consequence thereof, gradually to develope the members of the embryo, the process of incubation becomes necessary. The parents are then impelled, by an irresistible power, to sit with a patient assiduity for a proper length of time, according to the economy of the different animals, upon these eggs, and, by the genial heat which is thus produced, to bring into action the vital principle, and in due time to complete the infant creature in all its members. When it hath thus acquired the necessary degree of strength to enable it to perform the vital functions, it bursts its confinement, and issues forth a complete animal, in the form of the parent race to which it belongs. The egg, being in this business destined to perform the same office as the matrix of the mother in viviparous animals, must, of course, contain the rudiments of the infant-creature susceptible of being gradually developed, and also food to sustain the young embryo till it hath attained its full perfection.

Various methods have been suggested, at different times, for the purpose of preserving eggs from becoming stale and improper for use, but hitherto with but little success. The best mode that can be generally adopted is probably that of placing them in some sort of fine powdery substance, such as dry sand, salt, or such like matters.

When they are intended for the purposes of incubation, they should always be chosen as fresh as possible, stale eggs seldom succeeding well. See *Poultry*.

EGLANTINE, a term applied to plants of the briar kind. See *Sweet-Briar*.

ELBOW, in *farriery*, a term applied to the hind part of the fore-leg of a horse, pointing towards the brisket.

ELBOWS, a term applied to the shoulder points of cattle.

ELDEN, a provincial term signifying fuel for fire.

Elder, a term provincially used for the udder. See *Udder*.

Elder, the name of a well-known deciduous tree, which rises to a considerable height of stem, branching out extensively at the top, so as to form a bushy head, with pinnated leaves, having two or three pair of oval lobes, and an odd one, with large cymose five-paired umbels of white flowers near the ends of the branches, succeeded by large bunches of blackish berries. It is often used in making outward fences, on the sides of ditch-banks, or other places where cheapness and an immediate fence are the chief objects. This may be done by taking elder-cuttings or truncheons of from two to five feet long, and sticking them in the bank at the distance of eight or ten inches, sloping both ways, so as to form a kind of chequer work. Small cuttings form the best hedges. This sort of hedge should be kept down by clipping or cutting. The wood when large is very useful for turners and mathematical instrument-makers, being nearly equal to the best box, and for many uses surpassing it. The fruit or berries are useful for wine.

Elder, a term provincially applied to the alder-tree. See *Alder*.

ELECTRICITY, the collected effects of the subtile electrical fluid which pervades bodies, and from which various interesting phænomena are produced.

It is remarked by Dr. Darwin, in his Phytologia, that the mechanical theory of electricity, invented by Dr. Franklin, is believed by some philosophers not so well to explain the various phænomena of electricity as may be accomplished by an hypothesis of the existence of two electric fluids diffused together, and strongly attracting each other, one of them to be called vitreous, and the other resinous, electricity. The latter opinion he is inclined to espouse, but does not enter into any detail of the theory of it; he only observes, that the experiments on vegetation have been principally made with the accumulation of the vitreous electricity only, and the consequent exclusion of the resinous; that is, with what is commonly termed positive, and not with what is termed negative electricity. It is therefore to be wished, he says, that some future experiments may be made with the resinous or negative electricity, in preference to the vitreous or positive electricity, or with both of them alternately or comparatively.

The influence of positive or vitreous electricity, in forwarding the germination of plants and their growth, seems, he thinks, to be pretty well established; though Mr. Ingenhouz did not succeed in his experiments, and thence doubts the success of those of others; and though M. Rouland, from his new experiments, believes that neither positive nor negative electricity increases vegetation,—both which philosophers had previously been supporters of the

contrary doctrine;—for many other naturalists have since repeated their experiments relative to this object, and their new results have confirmed their former ones. M. d'Ormey and the two Roziers have found the same success in numerous experiments, which they have made in the two last years; and M. Carmoy has shown, in a convincing manner, that electricity accelerates germination. M. d'Ormey not only found various seeds to vegetate sooner, and to grow taller, which were put upon his insulated table, and supplied with electricity, but also that silk-worms began to spin much sooner which were kept electrified than those of the same hatch which were kept in the same place and manner, except that they were not electrified. These experiments of M. d'Ormey are detailed at length in the Journal de Physique of Rozier, tome XXXV. p. 270. M. Bartholon, who had before written a tract on this subject, and proposed ingenious methods for applying electricity to agriculture and gardening, has also repeated a numerous set of experiments; and shows, that natural electricity, as well as the artificial, increases the growth of plants, and the germination of seeds; and opposes Mr. Ingenhouz by very numerous and conclusive facts: Ib. tome XXXV. p. 401. The doctor's friend, Mr. D. Bilsborrow, in June 1797, sowed mustard-seed in four garden-pots at Mr. Hartop's, at Dalby-Hall, in Leicestershire. He subjected one of these to positive or vitreous electricity, and another to negative or resinous electricity, and observed that the seeds in the pot, subjected to the negative or resinous electricity, germinated a day before the pot subjected to positive or vitreous electricity, and both of them much before the two pots which were not electrised, but otherwise exposed to the same circumstances.

Nor, says he, do the injuries occasionally received from lightning in its passage through trees or corn-fields, from or to the earth or clouds, in the least invalidate this opinion of its general utility, as well as that of the fluid element of heat; for the excess of the most salutary stimuli becomes deleterious both to vegetable and animal bodies.

Since, by the late discoveries in chemistry, there is reason to believe that water is decomposed in the vessels of vegetables; and that the hydrogen or inflammable air, of which it in part consists, contributes to the nourishment of the plant, and to the production of its oils, resins, gums, sugar, &c.; and, lastly, as electricity has by late experiments been found to decompose water into the two airs, termed oxygen and hydrogen, there is a powerful analogy, he thinks, to induce us to believe that it accelerates or contributes to the growth of vegetation, and, like heat, may possibly enter into combination with many bodies, or form the basis of some yet unanalysed acid. The solution of water in air, or in caloric, seems to acquire electric matter at the same time, as appears from an experiment of Mr. Bennet. He put some live coals into an insulated funnel of metal, and, throwing on them a little water, observed that the ascending steam was electrised plus, and the water which descended through the funnel was electrised minus. Hence it appears, that though clouds, by their change of form, may sometimes become electrised minus, yet they have in general an accumulation of positive electricity. This accumulation of electric matter also evidently contributes to support the atmospheric vapour, when it is condensed into the form of clouds, because it is seen to descend rapidly after the flashes of lightning have diminished its quantity. According to the theory of M. Lavoisier, concerning the composition and decomposition of water, there would seem another source of thunder-showers; and that is, that the two gases, termed oxygen gas or vital air, and hydrogen gas or inflammable air, may exist in the summer atmosphere in a state of mixture, but not of combination; and that the electric spark, or flash of lightning, may combine them, and produce water instantaneously.

It is farther observed, that a profitable application of electricity, by the gardener or agricultor, to promote the growth of plants, is not yet discovered; but it is nevertheless probable, that, in dry seasons, the erection of numerous metallic points on the surface of the ground, but a few feet high, might in the night-time contribute to precipitate the dew by facilitating the passage of electricity from the air into the earth; and that an erection of such points higher in the air, by means of wires wrapped round tall rods, like angle-rods, or elevated on buildings, might frequently precipitate showers from the higher parts of the atmosphere. And, lastly, that such points erected in gardens might promote a quicker vegetation of the plants in their vicinity by supplying them more abundantly with the electric ether; if the events of the experiments of the philosophers above mentioned are to be depended upon, which may, he thinks, at least be worth a further trial.

ELM, the name of a very common deciduous tree, of which there are several species and varieties. Common elms are frequently planted in hedge-rows, upon the borders of fields, where they thrive well. They may also be planted in woods or close plantations, nor will their shade be very injurious to whatever grows under them. When they are transplanted out upon banks after the above manner, the banks should be well wrought and cleared from roots, otherwise the plants will not make much progress in such places. About Michaelmas is a good time for this work; and when they are planted, there should be stakes fixed in by them to which they should be fastened, to prevent their being displaced by the wind; part of their heads should also be taken off, before they are planted, which will also be of use in preventing their being overturned by winds; but their leading shoots should not be stopped, nor their branches be too closely cut off.

Trees of this kind are also proper to plant at a distance from gardens or buildings, to break off the violence of winds; as they may be trained up in form of a hedge, keeping them cut every year, which will cause them to grow very close and handsome, to the height of forty or fifty feet. But they should

not be planted too near a garden where fruit-trees or other plants are placed; because the roots of the elm run superficially or near the top of the ground to a great distance, and, by intermixing with the roots of other trees, deprive them of nourishment. Nor should they be planted near gravel or grass-walks, which are designed to be well kept, because the roots will run into them, and send forth numerous suckers, which deface the walks, and render them unsightly.

In planting of trees of this sort, care should be taken not to bury their roots too deep, which is very injurious to them, especially if they are planted on a moist loam or clay; in which case, if the clay is near the surface, it will be the best way to raise the ground into a hill where each tree is to be planted, by which their roots may be raised above the surface of the ground, and not be in danger of rotting in winter with moisture. When propagated by suckers taken from the foot of old trees, they are commonly laid into the ground very close in beds, where, in dry weather, they may be frequently watered, to encourage their putting out roots. In these beds they are left two years; by which time those that live will be well-rooted, though a great many of them generally die; they should then be transplanted into the nursery.

Some raise the witch-elm from seeds, which it generally produces in great plenty. These should be sown upon a bed of fresh loamy earth, and gently covered; in dry weather they should be watered, and if the bed is shaded from the violent heat of the sun, it will be of great service, as the plants come up better in the shade than when exposed to the sun. When the plants are up, they should be carefully cleared from weeds; and after they have stood two years in the seed-bed, they are fit to plant out into the nursery.

The common elm sometimes produces seeds, but is not so constantly fruitful as the witch-elm. The elm thrives best when planted on a strong loamy soil.

The timber of the common elm is generally preferred to the rest; though that of the witch-elm is often as good, and is the largest tree, when planted on a kindly soil; but the Dutch elm affords the worst timber, and never will grow to the stature of either of the other sorts, so that it should not be cultivated for timber.

ELYMUS, a genus of grasses of but little value to the farmer. The lime-grass.

Elymus *Arenarius*, sea lime-grass; a kind of grass which, together with the sea-reed, Mr. Sole observes, helps to support and keep up sand-banks from the incroachments of the tide.

EMBANKMENT, a large mound, or bank of earth, thrown up in a particular manner, for the purpose of protecting or reclaiming lands from being injured or inundated by the water of the sea, rivers, or lakes. It is remarked by Mr. Beatson, in a paper in the second volume of Communications to the Board of Agriculture, that there are many parts of the kingdom where wonderful improvements may be made by embankments, provided they are judiciously planned and properly executed. Immense tracts of valuable land may be gained, not only from the sea, but from large rivers and lakes; and the advantages that would accrue, even by preventing many of those rivers from overflowing their banks, and, in great floods, inundating the whole adjacent level country, are, he conceives, too manifest to require illustration. In some places, a bank of only three or four feet in height might, he thinks, at a very small expense, prevent thousands of acres being overflown, whole crops being carried off, and an immense deal of other damage being done. In other parts very trifling banks might be the means of gaining very large tracts of country, which in their present state, are perhaps of little or no value; and yet, so indifferent, says he, are most people about improvements of this nature, that although extensive tracts are overflown, and the most serious devastations committed year after year, they use no means whatever to prevent it; nay, although the sea itself, as if to rouse the slothful from their slumbers, presents to their view, twice every four-and-twenty hours, large tracts that might by proper means be made of great value, yet even these repeated invitations are disregarded, and no attempts are made to possess what might, in many cases, be so easily and so advantageously acquired. There is something, he says, so truly inconsistent and unaccountable in this mode of conduct, that it is very difficult to reconcile it either to common sense or to reason. It is not that people in general seem blind to the value of land, for in most cases they appear to be sufficiently tenacious of property, and to put a tolerably high value upon it after they do acquire it; but one would almost be led to believe that the generality of mankind feel a much greater pleasure and satisfaction in seizing upon the property of others, however distant it may be, than to use the means in their power of taking possession of what lies almost within their grasp; else how can we account for the strange infatuation of their encountering the utmost difficulties and dangers, risking and losing vast numbers of valuable lives, and expending immense sums of money in acquiring (although not sure of keeping) a small spot of land in a distant and inhospitable region; when at the same time a tenth, nay, sometimes a hundredth part, of the sum thus expended, would gain, without any risk or difficulty, perhaps as much of a more fertile soil on the shores of our own island, or the banks of its rivers. And, surely, there can be no doubt but an additional county, or tract of land, added to the island of Great Britain, contiguous to, or within its bounds, would, if properly cultivated, be of more permanent advantage to the nation at large, than double the quantity, in most cases, gained in a distant clime; consequently, although the possession of some colonies, or foreign settlements, is no doubt an object of the utmost importance to trade and commerce, and highly deserving of the greatest attention, yet the acquiring of additional territory at home is an object no less important, and ought therefore to have at least a share of

that attention and expense bestowed upon it which it so justly deserves. In some places, it is true, active and enterprising people have taken advantage of the opportunities that have offered. In Yorkshire, in Lincolnshire, in Cambridgeshire, and in other places, many hundred thousands of acres have been gained by embanking. In Holland, the whole country has in a great measure been gained in this way. Near Chester, the River-Dee Company have also gained some thousands of acres from the sea, which are now divided into several beautiful farms, one of which pays a rent of 500*l.* per annum. The others are smaller, but the whole together amount to more than 2000*l.* per annum, forming a very pretty estate, neatly enclosed, and subdivided by thriving hedges into square or rectangular fields.

Large sums have, he observes, been expended in some places by individuals, with a view of guarding against inundations; but owing to the embankments they have made being injudiciously placed, and as badly constructed, the desired effect has not always been produced, particularly in the northern parts of Cheshire, on the banks of the River Mersey, where embankments have been thrown up at a great expense, which, from the manner they are placed may, he thinks, in some cases, by confining the course of the river, do more harm than good. By the appearance of that part of the country, so far as he could judge from the cursory view he had of it, it seemed to him that the inundations from that river might have been effectually prevented at a much easier rate, if a proper method had been taken at first; but from a certain ill-judged and mistaken tenaciousness of property, the embankments are reared so close upon the sides of the river, that, in many places, it is confined to a space not more that twenty yards over. Owing to this, and to an aqueduct across the river, with only one arch instead of two, which it ought at least to have had, the water sometimes, in great floods, rises, he was informed, to the height of about twenty feet above its ordinary level, and overflows the embankments, although now, by frequent additions, they are about that height. Instead of twenty yards, had these embankments, says he, been eighty or a hundred yards distant from each other, and the river widened in the narrowest places, one-third or one-fourth of their present height would have been quite sufficient. They would have been much easier constructed, and less liable to damage by the floods, and a great deal of money would have been saved, not only in the first construction, but in keeping the banks afterwards in repair. Neither would that space of ground between the embankments and the river be altogether useless; on the contrary, it would have produced the richest pasture, or meadow-hay, by its frequent manurings with the fertilizing particles left upon it, when flooded by the swelling of the river; and in those places, if any, that are unfit for pasture or hay, willows or other aquatics might have been planted to great advantage; and thus it might have been of more value perhaps than at present, and the interior grounds more effectually secured from the ravages occasioned by a sudden flood. Notwithstanding the general indolence shown in most parts of the country respecting the acquisition of land by embanking, and the seeming aversion that most people have to engage in such undertakings, there have been, however, he observes, some ingenious and enterprising projectors, whose ideas upon that subject have soared far beyond the bounds allotted to common understandings. From the speculations of such people, the most important advantages are sometimes produced; and surely the man who is possessed of a speculative turn of mind, and who considers no obstacles insurmountable, is a much more useful member of society than he who is perpetually starting difficulties against every new project, and is for all things remaining *in statu quo*, that is, for leaving the world as he found it. The idea of embanking Lancaster Sands, for example, never would have occurred to a torpid genius of this kind. A thousand difficulties and impossibilities would have immediately started up at such a proposal, which, to a more expanded mind, appear perfectly practicable to overcome. What then must those anti-projectors think, when they are told it is proposed to exclude the sea entirely from these extensive sands, which form a bay, exposed to a south-westerly wind, more than ten miles across, containing a surface of near forty thousand acres, and where the tide rises about fourteen to eighteen feet perpendicular height.—Some proposals and estimates have already been made for carrying this project into execution. One very public-spirited and enterprising gentleman (Mr. Wilkinson) has offered to begin a subscription for that purpose, by leading off with the princely sum of 50,000*l.*; but so many unexpected obstacles have come in the way, he understands, by the claims of lords of the manors, and in proportioning the tythes, in the event of acquiring so large a tract of country, that few people have on that account chose to embark their fortunes in this immense undertaking, seeing that their profits may be liable to so many deductions; consequently nothing conclusive has yet been done in it. Ulverstone and Duddon Sands, on the same coast, are also proposed to be embanked. The latter, over which he went with Major Gilpin, a gentleman who has paid great attention to that business, appears to be the most practicable. According to his opinion, he says, there might be about nine hundred acres of very good land gained there, by laying out a sum not much exceeding 20,000*l.* If, on a correct survey being made by persons properly skilled in such undertakings, so valuable an acquisition is proved to be attainable at so small an expense, can there be the least hesitation about immediately commencing a project so highly advantageous to that part of the country, and to every individual concerned in it. But he will speak more particularly of these sands afterwards, when treating of embankments against the sea. He mentions them here in a general point of view, chiefly to arouse the attention of those who have the good fortune to be situated near places of a like nature, or such as are capable of so great an improvement,

and to show that even a tempestuous sea rolling into a bay ten miles across, is not always considered as an obstacle altogether insurmountable. That there are many large tracts in different parts of the kingdom, both on the sea-coast and on the sides of lakes and rivers, much more easily attainable than Lancaster Sands, or any of those sands here mentioned, there cannot be the smallest doubt; it is, therefore, surely worth the attention of those who are so fortunate as to possess property near such places to take the advice of the most intelligent people upon so important a subject, that they may form a judgment, whether the acquiring of a large addition to their estates, in this manner, is an object adequate to the expense.

Embankments for the protection or reclaiming of land may be divided into three different kinds; namely, embankments against the sea, against rivers, and against lakes, each of which should be formed according to the resistances required. The first of these, however, will in general require by far the strongest and most expensive works.

Embanking against the Sea.—When an embankment is proposed to be made against the encroachments of the sea, it must first, Mr. Beatson observes, be considered, what is the greatest depth of water at the highest spring-tides. About two feet higher than that should be the summit of the bank. Some have recommended only one foot higher, but it is best to err on the safe side; for the consequences attending an overflow, after the whole is completed, may, in one tide, do a great deal more damage than all the expense of the additional foot in height. This, he says, actually happened near Chester, several years after the embankments had been completed. An uncommon high spring-tide flowed over the top of them, and occasioned the greatest consternation through every farm: fortunately, however, it soon subsided, without doing so much damage as was at first apprehended; but the embankments were immediately raised higher, and no such accident has since happened. If the embankment is made at first even three feet higher than the highest rise of the tide, especially at those places exposed to the waves or swell of the sea, it will be so much the more secure, for new works of this kind always subside, or settle in some degree, after they are erected. It is a very necessary precaution, particularly if the banks are large, to take the levels frequently for some time after they are completed, lest they should subside too much, and thereby occasion a mischief, which, it was imagined, had been sufficiently guarded against. If the banks are but low, this precaution is not so necessary, for the settling will always be more or less according to their height, and in low banks will be but very little. It is hardly possible to give one general rule respecting the size and dimensions of such embankments. This must be regulated according to circumstances and situation, for which a skilful engineer will always make the proper allowances. If the embankment to be made is to exclude the sea from a low marshy piece of ground, over which it flows only at spring-tides, the operation is easy, and may be effected at a small expense. If it is intended to reclaim a piece of land that is covered every tide, either in some bay or creek, or on the sides or windings of some large river, in which the tide ebbs and flows, the work will be somewhat more difficult, in proportion to the depth of the water and the rapidity of the current. If it is proposed to exclude the sea from some exposed situation, either at the mouth of a river, or in a bay or inlet uncovered every tide, the work will be the most difficult and most expensive of all, in proportion to its exposure to prevailing winds, and to the depth of water to be resisted. Each of these situations require a different mode of management. Embanking against the sea, if at any considerable distance within high-water mark, is not only the most tedious, but the most difficult of all; for if the materials are not very good, and the work is not properly performed, the force of the water at every flowing of the tide will soon undo all that has been done, especially if the soil is of a sandy nature, as it often is in such situations. If it is a strong clay, as is sometimes the case in marshy places, there will be the less risk of its being washed away. In sandy situations it has by some been recommended to lay bundles of straw or reeds, well fastened down, or any other impediment, to prevent the soil being carried away by the ebbing tide. Where a sufficient quantity of good strong turf cannot be had, then expedients may be tried; but where such turf is to be got, as in most marshy situations, and where the embankment required is not to exceed the height of four or five feet, it is best to finish the slope with good turf as expeditiously as possible, as the embankment proceeds; that is, supposing a length of thirty, forty, or fifty feet, or yards, of it can be completed in a tide, it is better to finish that length to its intended height, than to trace out or begin a greater extent than can be finished before the tide returns, by which a great deal of the soil might be carried away, and much of the work demolished, which is not so likely to be the case when the slope is finished. Turf, containing the roots of bent or rushes, is very good for this purpose. The first thing, however, to be done in an embankment of this sort, is, to stake out the intended line of it, marking the breadth at the base, also the width of the excavation, or trench, to be made in the inside, from which most of the materials that compose the bank are to be taken; this trench also serves as a drain to keep dry the grounds within. At different parts of it should be trunks, or sluices, to shut of themselves against any external water, and to open, when the tide ebbs, to let out any water from within. Its width must be proportioned to the quantity of materials required from it for the embankment—eight, ten, or fifteen feet wide, and three or four feet deep, leaving a *berme*, or space, between the edge of the trench and inner bottom of the embankment. If the soil is strong, one foot or eighteen inches will be sufficient for this *berme*; if it is loose or sandy, it will require at least three or four feet.

The more gradual and easy the external slope is made, the resistance against the sea, it is observed, will of course be the less sudden, and the embankments less liable to injury: this slope must therefore be made according to its exposure to the winds and tides, but nothing can be a greater error than to make it too bold or upright. Suppose *fig.* 1. *pl.* XXXII. to be the section of an embankment of this kind; the horizontal, or base-line, *c b*, should be at least three times the perpendicular height *a c*; but *f d*, the inside slope, need not to be above three-fourths of the perpendicular height, that is, nine inches for every foot in height. The inside slope should also, he says, be faced with turf, which may be laid with the green side downwards, as in building any common sod wall. Some expert sodders, it is remarked, can finish this kind of work extremely neat, by setting the sod on edge, according to the slope intended to be given, and with proper mallets and beetles they ram the earth hard behind, which consolidates the work as it advances, and tends very much to its durability. When the first or lower course is finished, they pare the upper edge of the sods with a sharp knife, quite even, by laying a rule to them, and then they go on with the second course, which they finish in the same manner, and so proceed till the whole height is completed, which, when finished properly, looks very beautiful and smooth, not a joint between the turfs being seen. If turf is to be used in covering the outside slope, it must all be laid with the grass uppermost, and well beaten down with a flat sod-beetle for that purpose; and for their better security it may not be amiss to drive a small stake of about eighteen inches long, or more, through every sod. The sods for this purpose should at first be carefully taken up, and traced by a line, all of the same breadth, and their edges cut as even as possible, that they may make the closer joints, which will tend very much to their security till they grow properly together. In laying the different courses of these sods, care should likewise be taken that the joints of the one are covered by the other, in the way that good brick-work is made. If it be proposed to reclaim a piece of land upon which the sea ebbs and flows every tide, to a greater depth than in the foregoing case, as in a creek, or on the side of a large river, a different mode of proceeding must be adopted, according to the soil and to the materials intended to be used. If there are plenty of stones to be easily had, a bulwark may be formed of these, with a mixture of clay, either by land-carriage, or (which in some cases is preferable) by carrying them in flat-bottomed boats, or punts, and throwing them overboard till a bank is accumulated. If stones cannot so easily be had, a quantity of clay, or other materials fit for the purpose, thrown in in the same manner, may answer equally well. He thinks he has heard, that most of the embankments in Holland were done in this manner, by carrying the clay dug out of the canals in boats, and throwing it into the water. In either case it is necessary, he says, to fix up strong poles before the work is begun, as guides for laying down the materials. Sluices are also requisite at certain places to let out the back water when the tide ebbs; but the position and construction of these depend so much on local circumstances, that the engineer who conducts the work ought to be the best judge where and how to form them. A great deal depends on a skilful engineer in works of this kind, who will contrive many ways to facilitate the work, and to overcome all difficulties in the execution of it. A man of real genius, by his different contrivances, will often render the accomplishment of a great undertaking comparatively easy, which, to many, would be almost impracticable, or, at least, carried on at so great an expense as to counterbalance the advantages to be derived from it. He might, he says, even in such cases as we are now treating of, erect stages or platforms, so contrived as to carry on the work at all times of the tide, which would be a prodigious saving, for the delays occasioned by the tide in works of this nature are tedious as well as expensive; and waggons might be so constructed as to carry, on these platforms, large quantities of materials at once, to be easily emptied, and as easily filled; and they may be drawn by machinery in such a way as to save a great deal of expense in carriage, as well as in the tide-work.

It is remarked, that the next and last species of sea-embankment is perhaps the most important of any; for there are few estuaries, or mouths of rivers, where large and valuable tracts of land may not be gained by embanking. The shoals, or flats, formed at the entrance of such rivers, are often composed of the richest manures, or most fertilising particles, brought down by the stream from the towns above, or from the adjacent country through which the river flows. These shoals may therefore, by proper management, be in general very easily converted into the most fertile plains. Where such a situation happens, the first object is to collect the whole river into one stream, and to prevent its overspreading a wider extent than just sufficient for its discharge; or, perhaps, it may be better to alter the course of the river altogether, and to make it discharge itself at some other place. In this latter way, it has been proposed to reclaim that extensive tract, called Lancaster and Milthrop Sands, and also Ulverstone and Duddon Sands; and the principle, it is remarked, upon which that idea is founded is this:—It has been observed and proved by experience, that if the course of a river or stream is altered in such a manner as to make it discharge itself into the sea at a different place than it did before, the former place will, in a few years, by the constant accumulation of sand or mud brought in every tide, be so choked up or raised above its former level, as to form of itself, in process of time, a bank that, with a very little assistance, will quite exclude the sea; for as the current of the river before carried away all that sediment which the motion of the waves naturally stirred up, the current being removed, it stands to reason that all or most of the muddiness will not only be carried farther up the old channel

of the river, but a great part of it will be deposited there as the tide recedes. It has even been observed, that in spring-tides and particular winds this sediment is deposited in greater quantities than at other times; and he has been informed, that a gentleman in Lancashire, who has gained some land in this manner, has found, on making a perpendicular cut in the land so gained, that the different strata or layers were so distinct, he could easily distinguish those made at spring-tides from the rest. This is a very curious fact, and well worth the attention of all who have lands situated at the mouths of rivers, as there may, in many such places, be considerable tracts gained in this manner at a very small expense. Although this fact may be proved by experience in some places, nevertheless he should imagine the effect would not be the same in all situations. Where there is a great extent of flat or muddy shores, the motion of the waves will no doubt stir up the mud or sand, and carry great quantities of them along with the current on the flowing of the tide; and when the tide ebbs, although some of the lighter particles will be carried away again, yet it is natural to suppose the heavier ones will be left behind. If the shores are bold and rocky, except just near the entrance of the river, there will be the less of this mud; but, indeed, on such shores, there can be little or no occasion for embanking, unless perhaps in some creeks, narrow at the entrance and spreading wide above. From such creeks, if the sea were excluded, a great deal of land might probably be gained. A survey having been made of Lancaster Sands, and of the proposed alteration of the course of the River Kent, it was found that the length of the cut necessary to be made, from a little way below Dalham Tower to the River Lune, is 21,340 yards, or 12 miles and 1 furlong. This cut is proposed to be about 34 yards wide, and 4 yards of average depth, making an excavation of 2,902,240 cubic yards; the expense of excavating which, at 4½*d.* per yard, would amount to 54,417*l.* Perhaps this estimate is rather under-rated at 4½*d.* per cubic yard; but on the other hand, the average depth of the excavation, he presumes, is considerably over-rated at 4 yards, as a great part of the depth necessary may be made up by the soil thrown out; consequently, whatever is made up cannot be considered as a part of the excavation; besides, if the River Kent, Lindale Pool, and the other streams proposed to be taken into this new cut, require, when united, a space or channel to contain them whose transverse section is 136 yards superficial, it would be much less expensive, he should suppose, to add eleven yards to the breadth, and to take one from the depth proposed, unless it is necessary, from the level of the bottom of the river, to make the bottom of the new cut of a certain stated depth. The whole expense of completing this great undertaking has been estimated at only 150,000*l.*; and in the opinion of some gentlemen 50 or perhaps 60,000*l.* less might do. In this estimate he apprehends there has been no allowance made for the buildings necessary on so extensive a tract, nor for inclosing and draining, all which, as well as the interest of money laid out before any return can be expected, should be considered in estimating the expense of improving and bringing into a state of cultivation a barren waste of this nature. Moreover, it is natural to suppose, that in a space of near 60 square miles in extent, if it were ever brought to that highly-improved state, to which many people think it capable, there must of course be a considerable number of inhabitants upon it to cultivate the ground, and to colonize this new-acquired territory. In that case there must be places of religious worship; consequently, even the building of churches should be taken into consideration in a general estimate of this kind; besides, in the estimates he has seen, it is taken for granted, if the fresh water is conducted another way, as proposed, that in a very few years the sea will completely exclude itself from this extensive tract, and therefore no allowance whatever is made for any sort of embankment across those sands. He confesses he has not yet had sufficient experience in this mode of gaining land, or, as it is called, 'recovering it from the dominion of Neptune,' to put that implicit confidence in it, which many very intelligent and sensible men seem to do; and he should conceive it a very hazardous speculation to lay out so large a sum of money, merely on the faith of Neptune excluding himself, by performing the principal part. If this could be depended on, the speculation would be admirable, and the advantages and profits arising from so great an acquisition would be immense; but if, after laying out perhaps near 200,000*l.* in altering the course of the rivers, &c. it was found the sea left little or nothing behind, or if it did at one time, that it carried it all away at another, in what predicament must those concerned feel themselves? They must either lose the whole money laid out, or they must expend at least 200,000*l.* more, perhaps, in performing what they had trusted so implicitly to Neptune to do. If it were certain, he however remarks, that even a fiftieth part of an inch was deposited every tide, the success of the undertaking would be unquestionable, and a concern in it highly profitable; for in very little more than eight years, ten feet of perpendicular height would be raised, and it would be an easy matter to accomplish the rest.

He thinks the Duddon Sands are another tract where great improvements might also be made, and at a very easy rate too, when compared with that we have just now mentioned. In their present state, a great deal of land, that might produce the best crops, is frequently overflown, and rendered so wet and marshy, that it is of little or no value whatever. By altering the course of the River Duddon, and bringing it farther north on the low marshy ground, it appears to him, so far as he can judge without actually taking the levels, that not only the whole of that ground might be completely drained, but a considerable tract of sands reclaimed. The making of the new channel for the river seems perfectly practicable and easy, the ground being nearly

level (excepting a small rise at one place) the whole way, from where the new cut would begin, about 200 yards above Duddon Bridge to Haverig Pool, where it would empty itself into the sea. The length of this cut would be about six miles, which ought to be made navigable the whole way, with a lock near the sea, and a basin, with proper landing-places for delivering goods. The quantity of ground that might be gained, including the sands and marshy ground on each side, would, he says, in Major Gilpin's opinion, be about 6000 acres, and the whole expense under 20,000*l*. The quality too of this land has every appearance of becoming extremely fertile; as a proof of which, a farmer who some years ago gained a few acres of it, by embanking out the sea, has found that it produces the best crops of all kinds, even with little or no manure. So large a tract of valuable land to be gained at so very trifling an expense, is an object highly worthy of attention, not only as a profitable concern, but on account of many other advantages that would arise from it. It is therefore surprising to him that the neighbouring proprietors, or some enterprising private individuals, have not long ago taken the necessary steps to reclaim those sands. The execution of these projects would, he conceives, be attended with the most beneficial effects to a very large tract of country, and ultimately would be felt in some degree by the nation at large. There would not only be an addition of territory larger than either of the islands of Guernsey or Jersey, but it would tend to improve at least four times that extent of the interior country. A safe and speedy communication would be opened between the towns of Lancaster, Whitehaven, Ulverstone, Ravenglass, Dalton, Bootle, Egremont, &c. and all the intermediate country, instead of a mountainous and very circuitous route, or a precarious and dangerous passage over Lancaster Sands, in crossing which, many unfortunate people annually lose their lives. Independent of the advantages arising from the produce of the land to be acquired, the produce of the interior part of the country, which, in many places, is extremely fertile, and well cultivated, would be easily brought to market; whereas, at present, it is with the utmost difficulty and inconvenience that any commodity whatever can be transported over those dangerous sands and almost inaccessible mountains. By diverting the River Duddon into the navigable cut proposed, it would yield the most important advantages to the town of Broughton and all the back country, by facilitating the importation of coal, lime, and other foreign produce of every kind, and the exportation of slate, iron, and other productions of the country—a considerable trade being even at present carried on in slate and iron, which would undoubtedly be greatly increased by carrying these projects into execution. But although several public-spirited individuals have taken great pains to forward these truly laudable and important undertakings, yet the opposition, he is informed, that has been given by the proprietors of some trifling fisheries (who were offered a full indemnification), and from some lords of manors, who would neither contribute towards these improvements, nor relinquish any part of their claims to the ground when improved, has occasioned so many difficulties, that the matter has been for some time in a great measure dropped. It is hoped, however, that in these enlightened times, when the spirit for improvements of every kind seems to be aroused, these very important projects will be again seriously taken into consideration, and that every obstacle towards their completion will be removed. And if the idea of reclaiming Lancaster Sands should be considered as too expensive and too mighty an undertaking to begin with, an experiment might be made on Duddon Sands, where the money proposed to be expended is comparatively trifling, and where, if the scheme succeeded, there could not be the smallest reason to doubt, he supposes, of success in the other.

Embanking against Rivers.—It is observed, that embankments against rivers may be divided into two sorts; namely, for preventing their encroaching on the adjacent lands, and for protecting those lands and the neighbouring level country from being overflown when the water rises above its ordinary level. It may be observed, that where the course of a river is a straight line, or nearly so, it hardly ever makes any encroachment upon its banks, unless, perhaps, in very large rivers, when they rise above their common level, either owing to an increase in the waters, or to their being in some degree affected by the tides. In either case, the waves occasioned by a strong wind, where the river is wide, will moulder away the banks on that side upon which it blows, unless prevented in proper time. This may be done either by securing the bank properly with stones, or by driving a row of long piles pretty close together, at a little distance from the shore; the piles being of such a length, and so driven, that their tops may be always above the highest rise of the water. It is surprising the effect that piles driven in this manner have, in resisting the power of waves. Some years ago, when Mr. Beatson was on duty as an engineer at a fort near Portsmouth, built on a point of land much exposed to the sea, the waves made such havock, that the walls on that side were constantly giving way, although built in the most substantial manner, and having bulwarks of large heavy stone besides, to protect the foundation: however, all would not do; those bulwarks were soon knocked to pieces, and several times the wall itself. At length it was proposed to drive a number of piles at about forty to fifty yards from the fort. Those piles were twelve or fifteen inches in diameter, and driven about one diameter from each other, nearly in a straight line, parallel to the wall where the waves did so much damage. They were driven into the ground with a pile-engine, till perfectly firm, perhaps eight or nine feet deep, and about two feet of the top of them left above the level of high water mark. After this was done, the walls, he says, received no further injury, the space between the piles and the fort being always perfectly smooth, however tempestuous the waves might be without.

The same simple method might sometimes, perhaps, protect the banks of large rivers, if exposed to the waves, when other methods might fail.

But it is remarked, that the most common cause of rivers encroaching on their banks is the resistance occasioned by a sudden bend. In flat countries, apt sometimes to be overflown, where there are any such bends or windings in the rivers, it would be of great advantage to straighten the course as much as possible; for as every impediment, or obstruction, will naturally cause the water to rise higher than it otherwise would do, and as such bends have that effect, consequently in the time of a flood the waters will overflow a greater extent of country, and to a greater depth, than if the river had a free and uninterrupted course straight forward. If the windings of the river cannot be altered, and that encroachments are making on some part of the banks, it must first be considered whether the force of the water can be diverted to another place, where no injury can be done. If, for example, a river is encroaching on its banks at *a*, *fig.* 2. *pl.* XXXII. a jutty of stone a little way up the river, in the direction *b c*, would throw off the current towards *d*, and might totally prevent any further encroachment. On the river Nith, in Dumfrieshire, it is observed, a good deal has been done in this way by Mr. Millar, of Dalswinton, a gentleman of the most enterprising genius and most liberal mind, who has paid more attention and laid out more money in making important and useful experiments than almost any other private individual. The course of the river, where Mr. Millar has been carrying on his operations, is, he says, nearly as follows: *a c b c*, *fig.* 3. is the river; at *b* it was encroaching most rapidly, and seemed inclined to take a new course towards *f*, which would have destroyed some very fine land, and done a great deal of mischief in that part of the country. To prevent this, Mr. Millar made a large cut about 400 yards in length from *d* to *a*, and threw in a great quantity of stones quite across the river at *e*, to direct its course in a straight line from *a* to *d*. This had in a great measure the desired effect, by totally preventing its progress at *b*; but now it began to encroach on its banks at *c*. He at first endeavoured to prevent this, by driving in, at a considerable expense, a number of piles at a little distance from the bank, and wattled them with willows, branches, &c. thinking thereby to protect the bank. The piles were drove in with heavy mallets, apparently firm into the ground; they continued so for some months, till a heavy fall of rain came on, which swelled the river, undermined the piles, and carried them all away. But indeed it is in vain to think of piles doing any good in such a situation, unless firmly driven in by a pile-engine, for it is not possible to drive them in properly with mallets. This must have been the cause of their giving way so very soon. The piles not succeeding, Mr. Millar was resolved to try another plan. Several of his adjacent fields being covered with an immense quantity of stones, he ordered them to be gathered and thrown into the river, so as to form a jutty at *g*, a little way above the injured bank. Being obliged to go from home about that time, and to leave the execution of the work to some country people, they carried out this jutty too much at right angles to the stream. It had not therefore the desired effect, but rather made the matter worse than before; for if a jutty is carried out at right angles, as at *b*, *fig.* 4. the current will be forced from *b* to the opposite side of the river at *c*, and from thence it will rebound towards *d* more violently than it did before. But if a jutty is placed obliquely, as at *e*, it will force the current gradually towards *f*, in which position one jutty may do more good than several placed improperly at right angles. Mr. Millar was therefore under the necessity of making other jutties in this way, and has now the satisfaction to find that they answer the purpose intended. Those he made laterally, formed a sort of convex slope, the convexity being parallel to the current. Strong planks were also firmly set on edge among the stones, their ends pointing towards the river; so that if ever any current came so rapid as to move any of the stones, it must move them all in a body the whole length of the plank. Perhaps this precaution was unnecessary; for although stones are thrown into a river loose in this manner, the slush, sand, &c. that come down the river, will soon fill up all the cavities, and render it as firm and solid as a regular built wall. Mr. Beatson has been the more particular in this description, he says, to show the errors that Mr. Millar at first fell into, and the great expense they occasioned; whereas, had he been on the spot himself, and got the work executed as he intended, it would have saved him a great deal of unnecessary labour as well as money.

It is remarked, that the next sort of embankments against rivers are those to prevent them overflowing their banks, and inundating large tracts of country. This may be considered as the simplest and easiest of all sorts of embanking, if judiciously executed. It is therefore the more inexcusable to see in some places extensive tracts of the richest meadows completely overflown by every flood.—Few ordinary sized rivers rise more, even in the greatest floods, than five or six feet above their common level, unless when they meet with some considerable interruption or confinement in their course. But if interrupted or confined, they will rise perhaps twenty feet or more, as is the case with some parts of the River Mersey already mentioned. If, for example, a given quantity of water is six feet deep when running over a space twenty feet wide, it is clear if that space was made only ten feet wide, the water would rise to twelve feet; and if it were made forty feet wide, the same quantity of water would rise only to the height of three feet. It is therefore of great consequence, in preventing inundations, to give the river as much width as possible, by widening every narrow place. All kinds of obstructions should also be removed, whether occasioned by windings, shoals, stones, trees, bushes, or any thing else. In some cases, this may even preclude the necessity of embanking; but where embanking

is necessary, let the banks by all means be at a sufficient distance from each other, to contain with ease between them the largest contents of the river in great floods. The distance and height of the banks may easily be ascertained by measuring a section of the river when at its highest, or when the flood-mark is visible. By not attending to this, a great deal of money has been thrown away on the embankments on the River Mersey, and, after all, they do not effectually answer the intended purpose, a great part of the country being still overflown every time the river rises to any considerable height. Where a sufficient distance is allowed between the embankments, their height need not exceed from four to six feet. If irremoveable obstacles are in the way, which cause the river to rise higher, the banks must be higher in proportion. In either case, however, the slope of these kinds of banks on each side may be equal to its perpendicular height, and the breadth on the top about one-third of that height; which, supposing the bank six feet high, the base would be fourteen feet, and the breadth of the top two feet, as shown in *fig.* 5. The materials for making these banks should be taken as much as possible from the sides of the river, which will have the double effect of widening the river and forming the embankments; and there should be a trench on the inside (from which materials may also be got), with some sluices, as formerly directed, to drain off any water from within; also sluices to let in water from the river, if required, which would very much fertilise the meadows, if properly laid out for that purpose.

Farms situated on the borders of rivers are frequently, Mr. Donaldson observes, liable to much injury and inconvenience from them. 1st, From part of the soil being carried away in times of floods. 2dly. From rivers overflowing their banks. 3dly. From rivers in times of flood flowing back into the channels of the rivulets and streams that conduct the water from the more elevated and distant grounds to the rivers, whereby these rivulets and streams are made also to overflow their banks.

1st.—The danger of the soil being carried away in time of floods is increased or decreased according to circumstances; as, the form of the banks, the nature of the soil, the rapidity of the river, and the quantity of water that lodges on the margins of the banks, or falls over them into the river. When the banks of a river are perpendicular, especially if the soil be of a rich mouldering nature, the danger of part of them being carried away by floods is much greater than when they slope gently from the surface of the field to the bed of the river. When that is not the case naturally, they ought to be moulded into that form by art; as when a river, in place of being confined in its progress, has a power of efflux and reflux, the damage to be apprehended is inconsiderable, compared with what is likely to happen when, being restrained within two narrow limits, it is constantly struggling for an extension of space. When the soil is a rich free mould, and the under-stratum, opposite to the greatest force of the water, sand or gravel, this struggle never fails to be attended with bad consequences. If the soil and subsoil be one entire mass of clay or strong loam, and the current of the river do not press more upon one part than another, a most substantial improvement may be effected by sloping the bank, so that the declivity may be one foot, in three or four, from the surface of the field to the bed of the river. This some may object to, as sacrificing a certain portion of valuable land; but it should rather, he thinks, be considered as a premium paid for the insurance of the remainder, than as a total loss. If gravel mixed with small stones can be conveniently procured, spreading these materials on the sloping bank, to the depth of eight or ten inches, and till beyond the flowings of the river, will prove a good security against further damage; and if the bank be planted thick with any sort of willow, especially the Dutch willow, it will, in a short time, become an impenetrable fence, while the annual cuttings of wood will soon be equal to the heritable value of the land thus apparently sacrificed. Where no gravel can be procured, the new sloped bank should be immediately covered with well swarded turf, which should be pressed down as hard as possible, either with the back of a spade or with wooden mallets. If this be done in the beginning of summer, and willows be planted the following autumn, the improvement, he thinks, will be both effectual and permanent. In case the river run with extraordinary violence against any one particular part of the bank, it may be necessary to make a fence or bulwark of stone in the front of that place; the best way of doing which is, in place of building a wall, to drop the stones in a careless manner, but so as they may lie close together on the sloped bank. This is a much more secure mode of fencing, if the bank be made with sufficient declivity, than any stone wall that ever was built for the purpose; and while it is the most secure, it is also the least expensive; but care should be taken to lay the stones all the way from the bed of the river, till considerably beyond where the river flows in common. Where the soil is of a strong adhesive nature, and the under-stratum is sand or a pebbly gravel, it becomes in a much greater degree necessary to slope the banks. The water, when rushing violently along, has a powerful effect in undermining the bank, and carrying off these incoherent substances; so that the soil, having nothing to support it, naturally gives way, and frequently in such quantities as to occasion very serious losses both to proprietors and tenants. In all such cases, the slope should be made much more gradual than when the soil and subsoil is of the same quality, and such as will nourish aquatic plants. The banks having been sloped according as circumstances require, a thick coat of gravel, mixed with small stones, where such can be procured, should be laid on, so as to form a kind of natural beach, over which the river, when in flood, may have power to extend itself at pleasure. Should it be difficult or impossible to procure such materials as are proper for forming this best of all defences, strong thick sods should be placed on the surface,

in the manner before directed, which, if laid on in spring, or early in summer, will have time to unite, and to become one compact body before the autumnal floods (which are those whence the greatest danger is to be expected) begin to flow. If the subsoil be of such a nature as that willows will not grow, such sods as are full of the roots of rushes should be made choice of in preference to all others; as when these plants thrive and spread over the surface, it becomes in a great degree impenetrable by water, even in great floods, and when the river runs with considerable violence and rapidity. The directions above given will, he says, be found more or less practicable and useful, according as the river on ordinary occasions runs with greater or less rapidity. In level, or nearly level districts, all that is necessary is to secure full scope for the rivers to overflow their usual bounds without interruption; when that is secured by either of the methods before mentioned, floods, unless very violent, seldom do any material damage to the banks of rivers in such situations. It becomes, in many cases, extremely difficult to fence rapid running rivers in such a manner as to prevent part of the banks from being carried away by inundations. Sloping the banks would be attended with no good consequences. Even strong bulwarks made of stone are often swept away by the overpowering flood. Mr. Donaldson has, however, seen a method of fencing the sides of rapid running rivers adopted with success, after several other attempts had failed: it was by means of a sort of large baskets—provincially, 'creels'—formed of hazle, willow, &c. into a kind of open net-work, which, being placed along the bottom of the banks, were filled with stones. This is, he says, a very simple, and by no means an expensive expedient; and as these baskets may be made to contain two or three tons of stone, it can only be on few occasions, and in very particular situations, that a basket containing such a weight can be displaced or carried away. Such a mode of fencing as that now mentioned, he is perfectly satisfied, would prove effectual in many parts of Scotland and Wales, where the rivers run with uncommon rapidity. Owing to inattention, or rather to not being aware of the consequences, much damage is often, he observes, done to the banks of rivers in level districts, especially if the banks be perpendicular, and of a considerable height, by allowing the land-floods to fall over them into the river. As the water from the furrows approaches the bank, it is frequently stopped in the furrow of the head-ridge, which becomes for a time a kind of reservoir; the consequence of which is, that a considerable proportion of the water sinks and filters through the earth, which, being thus softened and swelled, is more easily undermined and carried off by the river. Sometimes little cuts or openings are made from the furrows across the head-ridge, for the purpose of conducting the rain-water into the river; here again the consequences are equally bad. Whoever will examine the bank of a river where this mode of management is adopted, and it is very common, will observe, that at every one of these cuts or openings, a little creek is formed, in consequence of the bank having been more softened, and by that means having become a more easy prey to the river when in flood. To prevent these evils, it is necessary, besides sloping the banks, to devote a part of the lands adjoining, to the breadth of twenty or thirty yards for instance, either to pasturage, or the growth of trees; and to form a drain at a proper distance from, and parallel to, the bank, for the purpose of collecting and carrying off the water from the furrows. Were this done, and were the water from this drain conducted into the river by conduits, formed a little above its ordinary level, much land, which is annually lost by neglecting this simple precaution, would, he is convinced, be saved or preserved.

2dly.—It is remarked, that injuries, although of another nature, are often sustained by farmers, from rivers overflowing their banks. Sometimes the farmer is prevented from sowing his fields; at other times, the crops of grain and grass are greatly injured, by being covered for a considerable time with water; and at others again, the whole produce of the year, the hay and corn-crops, are swept away. To prevent evils so complicated, and so serious in their natures, is certainly the business of every man, who, from the situation of his farm, has reason to apprehend, that, without using proper precautions, he may be subjected to such visitations. These damages can only happen in level tracts, where the banks of the rivers are low, and where the course is not of sufficient breadth to contain the water in time of flood. Some people, although very improperly, raise mounds of earth close to the top of the bank, and of a height exceeding that to which the river can be expected at any time to rise. These mounds, from being placed so near the river, are unable to resist the pressure of the water; and, by giving way, frequently admit a current into the fields, which proves much more injurious in its course, than if no mound whatever had been erected. Were a mound of earth formed on the side of the drain proposed to be made for carrying off the land-water, and were that mound well sloped on the side toward the river, it would, he thinks, be the most secure and effectual guard against rivers doing injury to the adjoining lands of any that could be adopted. By these mounds being placed at a distance from the river, the force of the stream would be much lessened, and the natural boundaries of the river greatly enlarged; as, in proportion as the mounds are removed from the centre of the current of the river, in like proportion will they become more secure, as being less liable to violent pressure. The propriety of erecting these mounds at a proper distance, must therefore be sufficiently evident; as when mounds are erected near the top of the bank, which can only be owing to ill-judged parsimony, they form, as it were, a part of the bank, and are liable to be undermined and swept away. Whereas, when they are placed at the distance of twenty, thirty, or forty yards, they serve rather as a boundary to confine the overflowing water, which glides along the bottom, than as a barrier

to prevent the encroachments of an impetuous river, during the time of floods.

3dly.—It is farther observed, that farmers, who possess lands in low situations, often sustain damage from rivers in times of flood, by their flowing back into the channels of the rivulets and streams that conduct the water from the more distant and elevated grounds to the rivers, whereby these rivulets and streams are made also to overflow their banks. The only precaution that can be adopted in such a case, or at least the one which, he says, appears to have the greatest probability of answering the purpose, is to erect mounds at a distance from the banks, and of a size proportioned to the quantity of water which, from the cause now mentioned, may be supposed at any time to stagnate in these channels. This may be done at a very trifling expense, either in money or land. If the proprietors do not choose to ornament the country, and improve their own estates, by planting trees on the borders of these rivulets and streams, the farmers may so construct these mounds as that they may become fences to their arable fields, while that portion of the farm necessarily and properly cut off for the protection of the remainder may be devoted to pasturage.

Various successful embankments have been made in the northern parts of the island within these few years. On the estate of Lord Galloway, lying in the mouth of the river Cree, near Cree Town, an useful work of this sort has been executed, by Mr. Thomas Hannay, who observes in the third volume of the Farmer's Magazine, printed at Edinburgh, that he "entered to the farm about four years ago, on a lease of twenty-one years, and his life; at which time upwards of 100 Scottish statute acres were regularly flooded by the highest spring-tides, excepting about three months in summer, when the tides were lower. They were seldom, however, covered above the deepness of one or two feet, and never above four or five. Eighty acres of the above consisted of a rich sea marsh, or *inks*, as they call them there, almost a true level, excepting where hollows were formed by the egress and regress of the tides, and the passage of fresh water from the higher grounds; and about four or five acres, which were about sixteen inches lower, being a younger marsh, and nothing but what they call ink-grass growing upon it (as he is no botanist, he can give it no other name); other grasses, such as clover, rib-grass, &c. grew on the rest of the marsh, forming a very beautiful close cover in the summer. The other twenty acres were at an average about eighteen inches higher; consequently, the sea did not cover it so often. It had formerly been ploughed, but not for about twenty years past. Last time it was in corn, it was flooded immediately after being sown, which rendered the crop almost entirely useless, and deterred former tenants from ploughing it again. He began to bank this field, he says, in the autumn of the year 1798, by making a dike along the side opposite to the river, in a direct line facing the east. This dike was made, at an average, about three feet and a half high, and six feet broad at bottom, and twenty inches at top, built after the same manner of" that mentioned below. "He inclosed, along with the said field, he says, four acres of the marsh adjoining, by making a dike five feet high, and five feet in bottom, almost wholly of solid feal or sods, with a very little stuff, properly beat, in the heart of it, which makes an excellent fence, and promises to be a very durable one. This dike, together with two small drains, one on each side of it, about two feet deep, cost 3*d.* per yard. He has been more particular in mentioning this dike here, he says, as the division dikes of the whole marsh, which is now divided into four parts, are all built after the same manner, only that there is no loose stuff in the heart of some of them, but all of solid feal, jointed like brick, as may be seen at A, in *pl.* XXXII, *fig.* 6, which represents an end-view, or section of it. This dike, meant as a permanent fence, answered as a temporary bank, and enabled him to plough that field in spring 1799, although the bank round the whole marsh was not finished till the winter following." He "sowed oats on this field, and, considering the badness of the season, had a very good crop; particularly so, on that part which had not been ploughed formerly. On further consideration, he altered the plan of the bank round the marsh, (which extends in a circular direction facing the north), by making it, at an average, about four feet and a half high, and allowing about two feet in the base for one in height: See *fig.* 7, where A B C represents an end-view, or section of it, every small span representing the section of a feal or sod; A B shews the inside of the bank, with the green side of the feal down; B C the base; A C the side next the water, with the green side of the feal out, (which adds greatly both to the strength and beauty of the bank); and D the heart of the dike, made up with stuff properly compressed with a rammer. The stuff was taken from a ditch in the inside of the bank, leaving a casement of a foot, which ought to have been three at least; and, where the ground is of a sandy nature, more; as the fresh water, running in the inside, was likely to undermine the bank, had he not prevented it, by cutting a new drain, and filling the old one with the stuff cast from it. The only creek worth noticing, through which the bank passed, was one about forty feet wide, and nine feet deep; in the bottom of which, a wooden pipe, with a stopper, was laid through the bank. No tide offered the smallest injury to the bank, till January last, when there was one of the highest ever remembered by the oldest inhabitant, which broke it at this creek. This, he thinks, was owing to the wooden pipe not being made strong enough, as the weight of the stuff and water pressed in the sides of it, and thereby admitted the water below. The tide made also three small breaches in that part of the bank, which was built after the first manner; but in the part made after the manner represented in the figure, no breach took place, though it was rather lower than the other part. There are now about fifty acres of the same kind of marsh land adjoining his; and also about 100 acres on the other side of the river, banked in, all

nearly in the same manner as represented in the figure. The bank on the farm adjoining his, suffered little, he says, from the high tide; but the one on the other side of the river was made almost a complete wreck, owing to its lying quite opposite to the south-west winds, which always send up the highest tides; but this is not the case on this side, these winds blowing right over their bank. In his opinion, the bank on the other side of the river, in order to be durable, would require to be thirty feet broad, and eight feet high, covered with feals, with the green side out; and that no stuff should be lifted within six or seven feet of it, the ground being of a sandy nature. It might be made after the form shown at *fig.* 8. He has, he says, now got the breaches in his bank made up, and is begun to give the whole a complete repair, by adding, at an average, fifteen inches to its height, and two feet of base for each foot in height. The whole bank is about 1500 yards in length, and, when the repairs are completed, will altogether cost him betwixt 80 and 90*l.*

"In the year 1800, he ploughed another field, he says, of about twenty-six acres of the marsh, besides the one formerly mentioned, on which he had an excellent crop of oats, thought by many to be the best they had ever seen. Last year, he had the same field, part in oats, and part in wheat; the wheat was a very good crop; and the oats, which were of the Polish kind, far exceeded the crop of the former year. Last summer, he levelled the old ridges of the first-mentioned field, all by the spade; gave it a complete summer-fallow; shelled and dunged it well; had part sown with wheat, part with potatoe-oats, and all with grass-seeds. The other field is sown, part with wheat, and part with beans drilled; and, what is very surprising, he says, although the wheat was covered several times by the salt water, when the bank was broke, some of it to the depth of three feet, yet it is all looking well. The whole marsh is, he says, this year, under the plough. It may be worthy of observation, that the four or five acres, which he mentioned as being a younger marsh, harrowed easier than the rest, and produced as good, if not better, crops."

In another improvement of this sort, performed on Carse land, by Mr. John Hayes, on the farm of Netherton of Grange, the property of James Peterkin, Esq. which had been let to him on a nineteen years lease. It was begun under an agreement with the proprietor to allow a year's rent, 195*l.* sterling, with an allowance to meliorate the houses to the extent of 150*l.* sterling in addition "about the 1st day of June 1802; and, in November, it was brought to its full height over the whole; so that the Carse has been completely defended from the sea ever since the spring-tides in October. He cannot positively ascertain, he says, the extent of ground gained, as it has not been measured since the dike was erected; but, from the last survey of that part of the estate, it would appear fifty acres were improveable; from which is to be deducted the quantity occupied by the base of the dike, the border on the outside, with a few detached spots, probably included in the measure." The method adopted for carrying on the operations, are thus stated in the useful periodical work noticed above.—"After looking over the Carse, and marking out the line or dike, the length of which is 1400 yards, mostly in a right line, except an angle at the distance of 300 yards from the west end, and a segment of a circle at about 250 from the south-east end, it was resolved to make the embankment six feet of height in the highest part of the ground, and to allow two feet of breadth in the bottom of every foot of height, as seen by the draught of the mould at *fig.* 9. After taking the level of the Carse, it was found, he says, that where the ground was low, and a good deal of it broken by runs of the sea and outlets for the water, the dike would require to be eight and ten feet high, to have it on a level at the top; so that the average will be nine feet high. The embankment was built in the following manner—It was begun on the highest ground, near the west end, and two moulds set up at the distance of seventy or eighty yards; the height six feet by twelve broad in the base; the slope on the outside six feet, on the inside four feet, and the breadth at the top two feet; the sides made up with feal from the broken ground on the outside of the dike, which were laid with the grass-side down, two feal deep on each side of the dike; the outside feal of the first course with the ends out and in, and the other running along; the next course, the outside feal running along, and the inside out and in, and so on alternately, each course consisting of a head and runner; the body of the dike being made up of the Carse ground from which the feal had been cut, and packed down by men with beaters. When this was brought to the height of four or five feet, another piece was, he says, begun, leaving an intermediate space, where there were any water-runs, for the egress of the tide: this was found necessary, to draw off the water from the low parts of the Carse, which would have been filled up in spring-tides; and, by coming in at the end and over the high ground, would have been prevented from getting out by the dike, if it had not been done in that way; so that the embankment was all in detached pieces, till it was brought near the height. These intermediate spaces were then filled up, betwixt the fall of one, and rise of next stream-tide, after laying down wooden pipes with stoppers, in the dike, to carry off the sink-water." He remarks, that "it was a great labour to get the work carried on; in some places having to cross over lakes and runs made by the tides, which required vast quantities of materials, the dike being in some places upwards of ten feet high, and twenty-two broad in the base: the greatest part of the dike is sixteen to eighteen feet broad. There was one lake, of 150 feet in length, and fifty feet in breadth, filled up with earth, clay, and sand, to the height of five feet; on which the dike was then built: This forms a mound, on the outside of the dike, of fifteen or sixteen feet broad; and through this there are pipes

and, to carry off the sink-water." He adds, that "a stream of water formerly ran this way; but it was turned by the west end of the farm, by cutting a canal, which conveys the water through the embankment there, by means of an outlet built of stone, with a sluice on the inside, raised to the level of the running water, and a folding door on the outside, to be shut by the spring-tides. At this place, a road, that formerly led to Findhorn at low water through the Carse, is carried over the top of the dike, by making a mound of earth at each side, with a gradual approach and descent." It is stated further, that "since the Carse has been inclosed, the tides have been so high, that the water, during a severe storm in November, was from six to seven feet deep at the back of the dike: the wind, being from the north, occasioned a heavy swell and surge, but no water came over the top of it." He says, "it is in contemplation, as soon as the ensuing season permits, to cover the outside with feals, the green side uppermost; and he has no doubt, when finished, it will effectually secure the lands from any further visitation of the sea. The expenses of the embankment cannot, he says, be well ascertained at present; but it will be a good deal more than is allowed by the proprietors." He adds, that "a great part of the land is already ploughed; but, the winter setting in so severe, prevented the whole from being done. It is intended to fallow it, in preparation for a crop of oats in the succeeding spring; but this intention may not be unalterably adhered to. There are various sorts of soil in it: some of it clay, sand, gravel, black rich earth, and parts of it of a mossy nature: In some places below the gravel, which may, he thinks, have been forced on by the tides, a thin stratum of clay, upon sand; and some parts clay and sand alternately. There are other parts not so rich as might be expected, the surface having been carried off by former tenants, for mixing in their dunghills or compost heaps.

In *fig.* 9, A is the breadth of the dike at the top, when finished.

B, the breadth of dike at bottom, being twelve feet, when it is six feet high.

C, the breadth when eight feet high.

D, the breadth when ten feet high.

F, the slope on the sea-side of dike, which is always equal to the half of the breadth of the bottom: the inside slope, and breadth of the dike at top, is equal to the other half.

E, is a plumb-rule in a frame, made to apply to the mould or dike; the intention of it was, to find if the dike was kept on the proper slope, where a line could not be applied from one mould to another, as in a round or turn, or when the moulds were obliged to be taken down; but this one only answered for the sea-side, another being used for the inside, to fit its slope." *Fig.* 10, scale of the mould one-eighth of an inch to a foot.

Many other improvements of this sort have been effected in particular situations, and with particular views. See *Hough Land* and *Rivers*.

An ingenious mode of embanking and preventing the water from soaking through the banks in fenny and moory situations, has been suggested by Mr. John Smith, of Chatteris, and is thus described in the fourth volume of Communications to the Board. He begins by observing, "that the great level of the fens is divided into three large levels; and that each of these levels is subdivided into numerous districts by banks: but as these banks are made of fen-moor, and other light materials, whenever the rivers are swelled with water, or any one district is deluged, either by rain, a breach of banks, or any other cause, the waters speedily pass through these light, moory, porous banks, and drown all the circumjacent districts. The fens have sometimes sustained 20,000*l.* or 30,000*l.* damage by a breach of the banks; but these accidents seldom happen in the same district twice in twenty years; the water, however, soaks through all fen banks every year, in every district; and when the water-mills have lifted the waters up out of the fens into the rivers in a windy day, a great part of the water soaks back through the porous banks in the night upon the same land again." And he adds, that "this water that soaks through the banks drowns the wheat in the winter, washes the manure into the dikes, destroys the best natural and artificial grasses, and prevents the fens from being sown till too late in the season. This stagnant water lying on the surface, causes also fen agues, &c. Thus, says he, the waters that have soaked through the porous fen-banks have done the fertile fens more real injury than all the other floods that have ever come upon them." As he has "been much concerned in fen-banking from his youth, he had some time back devised the plan which he now finds to answer so well, but found it extremely difficult to prevail with any gentleman who possessed a proper district, to give it a trial; however, this last autumn, he prevailed with a gentleman in the parish where he resides to try it, and which proved equal to his most sanguine expectations."

His plan of improved embanking is this: "he first cuts a gutter eighteen inches wide through the old bank, down to the clay (the fen substratum being generally clay); the gutter is made near the centre, but a little on the land-side of the centre of the old bank. This gutter is afterwards filled up in a very solid manner with tempered clay, and to make the clay resist the water, a man in boots always treads the clay as the gutter is filled up. As the fen-moor lies on clay, the whole expense of this cheap, improved, and durable mode of water-proof banking, costs in the fens only sixpence per yard. This plan was tried last autumn on a convenient farm, and a hundred acres of wheat were sown on the land. The wheat and grass-lands on this farm are now all dry, whilst the fens around are covered with water. This practice answers so well on this farm, that all the farmers in this parish are, he says, improving their banks in the same manner, and some have begun in adjacent parishes."

It is of course a practice that deserves to be more

fully known and understood in all such districts as have grounds of this nature, as by such means great advantages may frequently be obtained.

Embanking against Lakes.—It is observed by Mr. Beatson, that the last sort of embankment he shall notice is against lakes or loughs, as they are called in Ireland and Scotland, and meres in the North of England. It generally happens that the waters in those lakes subside greatly in the summer-season, and that they rise considerably in winter, or when the season is wet. In some lakes, the extent of surface overflown in winter so far exceeds what the water covers in summer, that it would be a great object, and in some cases a very valuable acquisition, to confine the lake within its summer limits, or at least to cut off some of its branches or creeks. If either of these is to be attempted, the principal outlet must; he says, first be examined, and that should be enlarged and widened considerably, which, upon the same principle as already mentioned respecting the widening of rivers, will prevent the water rising so high as formerly. If the levels will not admit of much depth being got, or if the ground is rocky, and would be difficult and expensive to deepen, let the breadth be increased as much as possible, and every obstacle cleared away, that the water may run freely in a shallow stream. If it is required to ascertain exactly, or to fix the future limits of the water, a section of the greatest quantity running out during a flood should be taken. Suppose this section, for example, is ten feet wide and four feet deep; by making it forty feet wide, the same quantity of water will not rise above one foot; consequently, by this means alone, three feet in height will be gained all round the lake, which, in case of embanking it, would be a very great object. The summer-season, when the water is lowest, is the best time to carry on these as well as other embankments. If, however, any materials are to be brought from a distance, they may be laid down or prepared at other seasons, excepting turf, which ought always to be used as soon as possible after it is cut. The manner of constructing embankments of this nature will be sufficiently understood from what is already said on the other sorts of embankments; observing, as a general rule, that where the materials on the spot will answer the purpose, they ought invariably to be used, although at the expense of digging a trench larger and deeper than would otherwise be necessary. It must also be observed, that in executing all sorts of embankments, the greatest care should be taken to make them perfectly firm and water-tight, by constantly beating and ramming them well, during the whole time of erecting them.

EMBROCATION, in *farriery*, is an application in a fluid form, usually prepared of volatile and spirituous ingredients, and mostly used to relieve pains, numbness, &c.

Mr. J. Lawrence, in his useful work, has furnished several *formulæ* of this sort, which, though their chemical combination may not always be exact, may be found useful in some cases, when externally applied.

The following is a saturnine embrocation, which may be kept for constant use in the stable:

Take of distilled vinegar, one pint; water, one pint; extract of lead, three tea-spoonfuls; oil of turpentine, two ounces. Mix them well together for use.

The following have been found beneficial in *strains*, by the same writer:

Take of the best vinegar, one pint; camphorated spirits, four ounces; white vitriol, dissolved in a little water, two drachms. Mix them well together.

Take of vinegar, half a pint; camphorated spirits, spirit of vitriol, of each two ounces. Mix them together.

Take of distilled vinegar, eight ounces; Castile soap, one ounce; sal ammoniac, half an ounce. Or,

Take of sugar of lead, alum, white vitriol, of each one drachm; japan earth, four ounces.

Powder and dissolve them in two ounces of tincture of roses, so as to make an embrocation. This is powerful as an astringent.

Take the whites of three or four eggs, beat them to froth, and add of roch-alum, finely powdered, one ounce; spirits of wine camphorated, oil of turpentine, of each half an ounce. Mix them well together.

Take of spirits of wine, two pints; Spanish soap, five ounces: digest them in a gentle heat until the soap is dissolved; then add camphor, one ounce; oil of origanum, one ounce.

The proportions of the two last ingredients may be increased where necessary.

The following is a simple *formula* from Bracken:

Take of oil of turpentine, one ounce; spirits of wine camphorated, two ounces.

According to Mr. Lawrence, it however, when *constantly* used, fetches off the hair; care should therefore be taken in using it to the skins of delicate, valuable horses.

EMOLLIENTS, in *farriery*, such remedies as diminish the force of cohesion in the solids, and of course soften and diminish the hardness and rigidity of the parts to which they are applied. And they not only relax and supple the solids, but also sheathe and soften the asperity of the fluids.

ENEMIES *of Fruit Trees.* See *Orchards.*

EPIDEMIC, in *farriery*, a term applied to such fevers, or other distempers of cattle, as are catching or infectious from a peculiar state of the atmosphere.

Horses, are liable to epidemic fevers, and to several distempers of that kind, such as the epidemical catarrh, strangles, staggers, &c. &c. See *Influenza.*

EPIDEMICAL *Catarrh.* See *Influenza.*

EPILEPSY, in *farriery*, a disease which occurs in various animals. It often seizes the horse periodically, but at uncertain times, and for the most part suddenly, with little or no previous signs. It generally proceeds from the same causes that produce vertigo, apoplexy, and lethargy; to all which it has a near affinity. Sometimes it proceeds from a fulness of blood. When convulsive diseases happen to

old horses, they generally prove incurable; because nature, being languid, gives but little assistance to the operation of medicines, or any other means made use of for their recovery. A horse in this state, reels, and his eyes are fixed in his head, he has no sense of what he is doing, stales and dungs insensibly, runs round, and falls suddenly, sometimes immoveable, with his legs stretched out, as if he were dead, except only a very quick motion of his heart and lungs, which makes him work violently at his flanks, and sometimes an involuntary motion and shaking of his limbs. At the going off of the fit, he generally foams at the mouth; the foam is white and dry, like that which comes from a healthy horse when he champs upon the bit. In the cure, it is common, first to bleed; but, if the horse be low in flesh, or has come off any hard journey, or is old, this should be sparingly used. Indeed, it is altogether improper in the majority of cases; as the epilepsy is usually a disease of debility, and not, as in the apoplexy, occasioned by too much blood.

Gibson advises the following bolus and drink after the fit:

> Take of assa-fœtida, half an ounce; castor, pounded, two drachms; Venice turpentine, the same quantity; diapente, one ounce: Make them into a ball with honey, adding oil of amber, one drachm.
>
> Take of pennyroyal, misletoe, of each a large handful; valerian root, one ounce; liquorice, half an ounce.

Boil them in a quart of water: let it be poured off, and administered after the ball.

It may be repeated once, and sometimes twice a-day at first, and afterwards once in two or three days. Purges and clysters, at proper intervals, are also advised to keep the body open, and prevent a relapse.

EPULOTICS, in *farriery*, such topical remedies as dry up humidity, repress fungous flesh, and dispose wounds or ulcers to be covered with skin. Strong metallic solutions are often useful in this intention for brute animals.

ERGOT, in *farriery*, a term applied to a soft horny substance placed behind and below the pastern joint of horses. It should be removed to the quick, by an incision-knife, in order to get at a bladder of fluid, that lies covered by the ergot.

Ergot, in vegetation, a disease affecting different kinds of grain and other crops. According to Dr. Darwin, as stated in his Phytologia, it takes place when seeds grow out into large horns, black without, as in sea-cale, rye, and in carex. It frequently attacks the rye in France, and sometimes, he says, in England, in moist seasons; the grain becomes considerably elongated, and is either straight or crooked, containing black meal along with the white; and is asserted to have the appearance of being pierced by insects, which are supposed to produce the disease. It is sometimes denominated *clavus* or *spur*, and *horn-seed*.

ERSH, land in the state of stubble after the corn has been cut. Thus we have pea, bean, and different sorts of grain-ershes, &c.

Ersh-*Crop*, such a crop as has been grown after the stubble was turned down.

ERYSIPELAS, in *farriery*, a disease of the topical inflammatory kind, in which there are many small inflamed pimples on the skin, which soon are formed into numerous small vesicles. Horses and other cattle are liable, though rarely, to erysipelatous inflammation. When it occurs, it very soon goes on to gangrene, especially in animals that have been much debilitated. Calomel, with bark, may be useful in this case.

ERYSIPHE. See *Mildew*.

ESCALLION. See *Scallion*.

ESCULENT, a term applied to such roots or plants as are eatable, as carrots, turnips, &c.

ESH, a term provincially used to signify the ash-tree.

ESPARCET, the same with saintfoin. See *Saintfoin*.

ESSE, a provincial term used in some places to signify ashes.

ETCH, a term signifying the same with ersh. See *Ersh*.

EULE, in *farriery*, is properly a worm that bred in an ulcer.

EVACUANTS, in *farriery*, such medicines as, by their stimulus, augment the excretions of the body. Of this kind are purgatives, sudorifics, diuretics, &c.

EVERLASTING-*Pea*, the name of a perennial plant of the vetch kind, which grows naturally in some places, is easily cultivated, and which annually yields a great burden of excellent provender. It may be cultivated to advantage as a green food for cattle, on any of the more strong sorts of soil.

EVERS, a term provincially applied to such stiles as open, in which case the top rail has a bolt of iron driven through it at one end, the other end falling into a notch in the opposite post, by which an opening is occasionally readily made.

EVERY-*Year's-Land*, such lands as have been cropped with a brown and white crop, or pulse and corn in alternation, for a vast length of time, without any intervening fallow. Extensive common fields in the neighbourhood of Gloucestershire have, Mr. Marshall says, been conducted under this management for "perhaps centuries."

EWE, the female of the sheep kind of animals. See *Sheep*.

The practice of milking ewes is highly prejudicial to the animals, and is said to be an unprofitable custom, that is much on the decline at present.

Ewe-*Cheese*, that sort of cheese which is made from the milk of the ewe. See *Cheese*.

EWER, a term provincially applied to the udder. See *Yewer*.

EXCRESCENCE, in *farriery*, any circumscribed protruding substance growing on the skin, or on a bone, and which issues either from a neck, root, or other slender attachment, or, at least, from a point

whose superficial dimensions are smaller than those of the tumour itself. When this happens to a bone, it has the name of *exostosis*, of which the spavin in horses is a very striking instance.

EXCORIATION, in *farriery*, an abrasion, or rubbing off of the skin, so as to exhibit the fleshy fibres to view. It is very commonly occasioned by an unequal pressure of the harness, particularly the collars of draught-cattle. The cause, whatever it be, should be done away as soon as possible, and the parts washed with lead-water or alum-water, and dressed with a pledget of common cerate.

EXERCISE, in *horsemanship*, is that kind of bodily exertion which animals use spontaneously, according to the share of activity naturally belonging to them; or to which it may be necessary to compel them, for the preservation of their health. Almost all domestic animals require the stimulus of exercise, but especially those that are distinguished for their fleetness, and of all others the horse. Such of these animals as stand too much at rest, are at the same time full fed, and breathe constantly a hot, foul, stagnated air in close stables, cannot, it is well known, be long preserved in a proper habit of body, or remain fit for actual service. In order that they may perform the labour expected from them with ease and freedom to themselves, and with pleasure to their riders, it is the interest of the latter to attend particularly to their being properly exercised.

It has been asserted by Mr. Clark, "that a much greater number of horses which are high fed, and stand inactive in close warm stables, die of diseases arising from the want of regular exercise, than from any other cause whatever." He adds, that "as horses are formed for labour; inactivity, with full feeding, renders the body dull and sluggish. The stomach is loaded with food, which it cannot properly digest; the food is detained too long in the bowels: hence indigestion, costiveness, and flatulencies. The intestines, in this loaded state, press upon the surrounding viscera, and obstruct the circulation of the different fluids in them. The liver, mesentery, and spleen, are exposed to be injured from this cause; their natural functions are impeded; the animal economy is disturbed: and, when this is the case, the constitution cannot but be injured, and diseases ensue. The natural secretions are not in due quantity: they, together with the perspiration, are retained in the body, and are absorbed or taken up again into the mass of humours; and hence arises another source of disease. The circulation of blood through the whole system is slow and languid: hence the humours or juices are not properly prepared; glandular obstructions are formed in different organs of the body; the *sheath* and legs swell; running sores take place in the latter, commonly called *grease*; and the whole mass of fluids is greatly disposed to putrefaction: diseases follow, and death frequently concludes the scene." While "on the other hand, constant and habitual exercise, he says, renders the body strong and active, and, at the same time, fit for the most violent exertions of strength; it assists the heart in promoting a free circulation of the blood and juices through every part of the body; it creates an appetite, and promotes digestion, and thereby greatly assists in converting the food to nourishment; it promotes all the secretions and excretions, which enlivens the body, and gives room for fresh supplies of nourishment; it invigorates the whole system; it gives a flow of spirits, and adds firmness and strength to the muscles and sinews." In short, without a certain proportion of exercise, no animal body can enjoy health for any great length of time. But the effects of exercise on horses are not, he says, confined to the preservation of their health: in many cases of incipient disease, they likewise soon become visible. When, for instance, it is used as a remedy in horses that have swelled legs, &c. from standing idle in the stable: for, though such horses may have been declared full of humours, and that nothing could relieve them but purging, diuretic, or alterative medicines, it has been frequently found, that regular exercise, frequent rubbing of the legs (which is topical exercise), with a roomy stall to stretch their legs when they lie down, have removed the complaints without any thing else being done.

Rides or covered ways, for exercising horses in all weathers, are extremely useful; and no stable-yard, in a large town, should be without one; though, at the same time, the open air is preferable.

It is obvious, from what has been said, that horses should be accustomed to exercise by degrees; as all sudden changes, whether from idleness to active exercise, or from exercise to idleness, produce considerable changes in the system, and render both the solids and fluids liable to disease. When accustomed gradually and regularly to exercise or labour, it becomes easy to them, nor will any stiffness or difficulty of breathing follow from it. After a horse has arrived at this state or habit of body, he is said, in the stable phrase, to be in *wind*.

Another great source of disease in horses is, he says, the improper treatment of them after they have been *overheated* by labour. Although a horse be all over wet and smoking with sweat, still ignorant grooms and hostlers will insist, according to their own way of expressing themselves, that he is not heated *at heart*, and will rashly expose him to the cold air uncovered, tied at the stable-door, and even allow him to drink his belly-full of cold water in this condition. By being thus exposed to cold air, or drinking cold water, the blood-vessels, Mr. Clark says, contract suddenly (for it is the same, in effect, whether cold be applied to the internal organs, as the stomach or lungs, or to the external surface of the body); and hence violent inflammation of the lungs or other vital parts, gangrene, &c. and all the well-known diseases that are consequent upon obstructed perspiration. Death indeed is frequently the consequence, or the horse so treated is seized with the most violent acute diseases. In order, he says, to avoid these consequences, these evil practices should not only be resisted, but care be taken in hunting, where it is necessary to ride through

rivers or pits, to do it with as much caution as the case will admit.

It is suggested, however, that like many other things relating to horses, exercise, given for the mere purposes of health, may be carried to excess, and, consequently, may prove rather hurtful than beneficial; of course, the time and manner of regulating it deserves attention. Thus, it would be imprudent to cause a horse to exert himself too suddenly after he is newly fed and watered, because his stomach is then too full. Horses, in this case, should be made to move slowly and gently at first setting out. They will naturally mend their pace of themselves. Their exercise should be continued in proportion to their strength, manner of feeding, and the labour, &c. required of them; and this should not only be repeated every day when it is practicable, but increased as circumstances may require, in order to avoid the consequences of broken wind and asthmatic affections. And it is also improper to take out horses to exercise in wet or rain, or when they are not able to bear it, either from former fatigue, from hard labour, or when they are sick or lame. And still greater caution is necessary to be observed with regard to horses that are very fat. These require a long course of very moderate and regular exercise before they can with safety be put to that which is the least violent. The want of attention to this circumstance frequently occasions sudden death; particularly in horses that have been fed with much boiled meat, in order to fatten them for sale.

EXPERIMENT, an attempt or trial of any kind, made in order to discover an uncertain or unknown cause or effect.

EXPERIMENTAL-*Farm*, a kind of farm set apart for the purpose of making experiments in the various departments of agriculture. It is observed by Mr. Young, in the fourth volume of the Annals of Agriculture, after lamenting the want of attention to the improvement of agricultural knowledge in sovereigns, that the establishment of such a farm as would be attended with a real and undoubted advance of the science, is an object beyond the revenues of any society with which he is acquainted. There are, however, he says, noblemen, in this and in every kingdom of Europe, rich enough to execute it; but it is properly an undertaking for a sovereign. It would have great effects in promoting agriculture in this kingdom; but in others where that art is still less understood, it is absolutely essential to the progress of it. If, continues he, in some future age, this art, so necessary to the welfare of mankind, should receive an attention that has hitherto been denied it, and an experimental farm should be established, the following hints may be found of use.

A divided attention to complex questions should, he thinks, be avoided; and those great leading objects most nearly connected with the deficiencies of the national agriculture would demand the first exertions to ascertain. With this view the soil of the farm should regulate the plan of it. If it was a sand one in England, it should be thrown into the Norfolk husbandry, and the object of the experiments would be to examine how far that system, by means of carrots, turnip-cabbage, and other new plants—equi-distant drilling—manuring for the roots and grasses instead of the wheat, &c. could be improved. Connected with this inquiry would be the collateral one of the breed of sheep proper for this soil; with other objects too numerous to recite, that are at present unascertained.

If the soil was clay, or a loam too wet for turnips, the great objects would, he says, be the means of banishing summer-fallows—an inquiry of great importance; the culture and use of cabbages; the modes of draining by hollow cuts and arched lands; the best means of converting it to a meadow; and the proper breed of cattle, &c.

On a loamy soil, strongly inclining neither to clay nor sand, very interesting inquiries are, he observes, to be pursued. Every plant, common on all other soils, is to be cultivated on this. The rotations of crops; the culture of potatoes and carrots, and their application to all sorts of cattle; lucerne, and its use in summer-feeding a dairy of cows, that are supported in winter on the roots, &c. are among the numerous inquiries to be prosecuted on this soil.

On chalk, the principal object, he thinks, is the culture of saintfoin, and the best means of converting it to corn and turnips preparatory to a renewal.

On a peat-moor many dubious points are, he remarks, to be ascertained; the best means of reclaiming, whether by paring and burning, fallow, or mere manuring. The grasses proper to lay down with; and the means, by roots or cabbages, of supporting the greatest possible stock of that breed of cattle and sheep which are found by experiment most proper for the soil. The method of draining, manuring, and giving solidity to bogs, &c. Upon all, or either of these soils, collateral inquiries would arise in relation to manures, tillage, instruments, &c. and a great variety of doubtful points to be decided in the culture and management of all the plants usually cultivated on any of them.

A small botanical-garden, of two or three acres, under a botanist, for small experiments upon plants not cultivated but promising; and a laboratory for chemical trials on soils, manures, and vegetables, would, he conceives, be two necessary additions to such an establishment; and with a smith's and wheelwright's work-shops, would render the whole complete.

The great features of such a plan, says he, would be utility; it would, however, be susceptible of no inconsiderable ornament. The lines of the inclosures might be decorated in any imaginable way, provided the contents of the field applicable to useful grass or corn were traced by right lines. Every tract of land, of a considerable extent, has some broken ground, steep slopes, water-courses in glens, or pieces where the plough cannot move with convenience, and where grass is not an equal object with more level spaces; these, by a judicious dis-

position of the ground, might be connected with the margins of the fields, and, by walks being traced through them, might be made highly ornamental and pleasing. He never sees one of Mr. Brown's winding-walks, with its usual accompaniment of shrubs and velvet lawn, surrounding thirty, forty, or more acres of grass, but he figures to himself the variety such a space is capable of, by being thrown into experiments, that yield a food for the mind as well as the eye. Some delicious spots, it is true, unite so happily in all their parts, melting by an easy gradation into so rich a harmony of distribution, that any change would offend as much as dissonance in a piece of pleasing music. But such spots are rare: in general, the variety of neat and elegant experiments would not injure the effect at all. The leassowes was, he says, in all its parts a farm, and much more agreeable to the eye than had the whole been lawn. But in the present system of decorating ground, you want variety of effect; something to bring variations to the scene in which the owner shall be interested. The lawn that was smooth yesterday is smooth to-day, and the revolution of the seasons, that bids the rose breathe its perfume in June and wither in November, brings to the eye a succession of the same images which please this year as they pleased the last, without novelty in the cause or increase of pleasure in the effect. The highest decoration of landscape will not give it the power of variety: it will be the same this August as it was the last; it will be gay in summer, and dreary in December: its forcible effect is for others, not yourself; for at every repetition of viewing, the colours fade, and what once excited rapture, now brings no other emotion than cold approbation. The beauty of a mere garden-scene is like that of a mere fine face; it moves admiration at first, and we feel ourselves under the enchantment of a spell that chains all our senses; but let the enchantress speak, and prove herself a pretty fool, the inanity of her conversation breaks the spell, and she is from that moment less than a pretty picture, since no one claims a merit in making her. The beauty of a garden-scene is much of the same kind; it holds little conversation with you; it suggests no new ideas; it furnishes no food to an inquisitive mind. If he is told that he may contemplate the works and wisdom of God, and hold converse with the vegetable and animal creation, he replies, not because he is in a garden, for a nettle is as wonderful a production of divine power as a lily, and the structure of a toad an object to philosophize on as much as a nightingale. Hence the contemplative pleasures of a decorated scene are not appropriated; they arise from the parts and not the combination; and, therefore, in this respect, might as well not be combined at all. But when the ornamented walks lead you to something that offers novel information with every season; when you are in the pursuit of unknown facts, to ascertain which is to promote not your own solitary pleasures and contemplations only, but a science intimately connected with the prosperity of a nation; when every inclosure is pregnant with instruction—the field of a pursuit, and consequently of a pleasure; in such a case, it is not a question of an arrangement of lawn, and water, and shade, that shall please the eye for a time; it is not the bloom of a flower, or the bend of a walk, but a subject where the renovation of the year brings perennial employment for the mind: your landscape becomes the source of thought; the eye may be pleased, but the understanding is satisfied; and, instead of modes of decoration that have been repeated to satiety, a novel scene is created, at once the theatre of private pleasure and public instruction; where useful knowledge is sought, not in vain theories and indolent speculation, but in the vigour and activity of experimental exertion. Compared with such an application of a tract of land, what, says he, are parks and gardens, shrubberies and decorated grounds—but so many baubles to please children—frivolous efforts to fill the eye, but leave the mind vacant? The prince that raises palaces, and embellishes the gardens that surround them, may be commended for his taste, and praised for his magnificence. Versailles was called a creation: but had Lewis XIV. established such a farm as he has described; had the experiments been registered, and published for the benefit of France; how little would the reputation of that creation now be found, compared with the genuine and never-dying fame that would have sprung from a different application of the same ground! The prince that rears a palace does what princes have done before him; but he who founds an establishment for the instruction of his people in the most necessary of all arts, does that which none have done before him, and deserves a title more truly valuable than that of *Great*, so often ill applied to the destroyers, not the protectors of humanity;—he will enjoy the title of *the Friend of Mankind.*

It is likewise observed by the author of Modern Agriculture, that a mean by which a general spirit for agricultural improvements may be most effectually introduced is the establishment of experimental farms. This is a measure, it is conceived, that there is every reason to believe would be attended with good consequences, in regard to determining with precision the proper quantities of the different manures that ought to be applied to the various soils, the kinds best adapted to each, and the effects they produce when applied singly or in their compounded state. But the utility of public experimental farms in every county, if put under the management of men of extensive knowledge and experience, ought not, he says, to be estimated by a reference to any particular branch: husbandry, in all its branches, would be greatly improved by such establishments: and, should the period ever arrive when the obstacles to it shall be removed, and proper means adopted for diffusing a general knowledge of the best modes of conducting the various operations connected with that science, the one now suggested must not be omitted. Such farms would, he thinks, become so many seminaries, at which youth might be instructed in the art of agri-

culture; and to which also the practical farmer would occasionally resort for information, regarding the success of experiments made as it were under his own eye, and on soils and in situations similar to his own.

Mr. Marshal, in his Rural Economy of the Midland Counties, has also thrown out many useful hints on this very interesting subject. He states the advantages which the farmers of Great-Britain at large would receive from the establishment of farms of this description in the following manner:—"What man, whether of the superior class of yeomanry or tenants, or of the superior class of tradesmen or others, who are now bringing up their sons to husbandry, would not, after his son had gone through a course of private tuition, and received the rudiments of instruction from himself or some professional friend, wish to perfect his education in a public seminary; where he would have not only an opportunity of seeing practice in its highest state of improvement, and of conversing with professional men of the most enlightened understanding, but where he would be duly initiated in the theory of rural knowledge, in the method of making, registering, and observing the result of experiments; of ascertaining the inherent qualities and improving the various breeds of live-stock; where he would see order and subordination, and learn the proper treatment of servants; and, among a variety of other branches of useful knowledge, the form and method of keeping farm-accounts, and of ascertaining with accuracy the profit or loss upon the whole and every part of his business; consequently of bringing it, as nearly as in its nature it is capable of being brought, to a degree of certainty?"

Dr. Anderson, the ingenious editor of Recreations in Agriculture, seems, however, to have some doubt of such establishment being so advantageous. There are two ways, says he, in which facts respecting this department of science may be attained—experience and experiment; but both are liable to objections, which render their decisions, in many cases, fallacious. By the word *experience*, we denote those deductions that a man draws as the average result of practice continued for many years; and, although this be undoubtedly the surest guide that a man can follow, where his observations are sufficiently accurate, and the circumstances so clearly discriminated as to occasion no sort of confusion, yet, where these peculiarities are wanting, the deductions thus obtained may be extremely fallacious. What serves to augment the evil in this case is, that if conclusions have been once drawn, in consequence of an imperfect discrimination of circumstances, there is scarcely any hope of eradicating that error; because the mind once accustomed to move in a certain track, delights to proceed in the same track ever after; and the same indiscrimination which produced the first error, will induce a succession of errors of the same sort *ad infinitum.* But it happens unfortunately, that, in agriculture, things which may affect the result of an operation are so jumbled together, and confounded into one chaotic mass, that it becomes a matter of extreme difficulty for the nicest observer to discriminate those that are essential from the merely accidental, so that it is the easiest thing imaginable for the one to be mistaken for the other. The inaccuracy, also, which too much prevails in the operations of agriculture, respecting the actual expense of different operations as affecting any one individual object, as well as the difficulty of keeping separate the different produce of each field, renders it, he says, impossible for the actual farmer in most cases to ascertain with any tolerable precision either the expense or the value of the produce of any one of his fields; so that the profit or loss of any one operation is merely guessed at, not ascertained by his experience; and of course he is at liberty and will naturally draw the conclusion that seems to confirm his own pre-conceived notions upon that head. Experience then, under these circumstances, is, he thinks, a very fallacious guide. It may indeed give indications of what ought to be pursued or avoided; but, unless facts shall be ascertained with a greater degree of precision than that in general admits of, they must afford a very unstable foundation for any kind of scientific progress.

Experiment, continues he, hath been adopted with a view to supply these deficiencies of experience in agriculture; and though it promises fair at the first view to effect these purposes, yet upon a nearer inspection it hath not been found altogether adequate. An experiment in agriculture is a particular operation, undertaken with a view to elucidate some fact that is doubtful: extreme accuracy, therefore, to guard against every circumstance that might unintentionally affect the result, is an indispensable requisite in every experiment; for, unless this be done, the same experiment, under different circumstances, may lead to a variety of conclusions. But farmers, in general, having been little accustomed to the nice discriminations of scientific investigation, are but poorly qualified to guard against the secret influence of causes, which they have never so much as suspected of having any power upon the result of their experiment. From these causes, the experiments made by actual farmers often, he says, prove extremely defective; and, when amateurs of a higher rank project experiments, the detail of these experiments must be left to servants and dependants, who, in general, put down at random all the circumstances that their carelessness prevented them from observing; so that these experiments, though they assume a more engaging appearance of accuracy, are, in fact, for the most part, more inaccurate and erroneous than the former.

To remedy these evils, says he, the idea of an experimental farm has occurred to many persons as the only means of accelerating the progress of scientific agriculture; and the benefits that would accrue from it are indeed so obvious, when slightly adverted to, that the gentlemen in several districts of Britain have gone so far as to provide a fund for the support of an establishment of this kind; but, upon a near investigation of the subject, they have all found

difficulties in the way, which they have not been able hitherto to surmount. Indeed, it is so rare to meet with a person of a mind sufficiently enlightened to be able to comprehend the circumstances that are of essential import in an experiment, and to discriminate them from those that are not, and who is at the same time actuated by so much zeal in the cause, and endowed with such persevering assiduity, as to resolve to see all with his own eyes, without ever suffering himself to be so far drawn aside by some favourite pursuit as never to neglect it, that we have, he thinks, scarcely room to hope that such a man can ever be found. If such a person could even be discovered, he must be very particularly circumstanced indeed to induce him to think of undertaking such a charge. His circumstances must be so narrow, as to render the salary annexed to his office a pecuniary object of great importance to him; while his disinterestedness, or integrity, must be also such as to raise him far above the suspicion of appropriating to his own use the smallest iota beyond it. He must, at the same time, have a firmness of mind that is not to be diverted from stating what he sees to be necessary at all times, and to oppose every thing that he knows would prove detrimental to the undertaking. Without these requisites in the conductor, the end of the institution must, he thinks, be frustrated; because there would be no proper balance to counteract the unfounded projects of many of the pecuniary supporters of the institution. But where is the body of men to be found, who would admit the idea of having a servant, as they would deem such a man to be, invested with a power thus to controul their will? or, will any man who possesses the superiority of mind we here suppose, condescend to put himself into the humiliating situation that such an office must necessarily imply? He thinks the circumstance utterly impossible. If the salary were made high, persons of influence, who were very unfit to discharge the duties of the office, would, he says, make interest to obtain it; and, by means of that influence, and a polite conviviality of behaviour, would retain it, to the satisfaction, it is probable, of all the parties concerned, though the object of the institution would thus be totally defeated. If the salary were low, the director must, he thinks, become a poor independent thing, who would court the favour of some powerful members of the institution, and become a tool in their hands, to effect some favourite purpose they had in view, which would soon produce a disgust among the body in general of the supporters of the institution, and necessarily hasten its total dissolution.

For these reasons, his hopes of the benefits to be derived from the establishment of an experimental farm are by no means so sanguine as those of many others. Indeed, there are many experiments of the very first importance in scientific agriculture which are, he thinks, totally beyond the sphere of an experimental farm. Of this nature are all those facts which respect the original constitution of soils, and the infinitely diversified, though little obvious qualities these possess in consequence of peculiar impregnations they may have derived from the operations of nature or of art. An experimental farm is, in regard to this particular, precisely the same as another farm, in which the experimenter, like the farmer, may in time acquire a knowledge of what will suit his own soil. But if these experiments were published under the idea that the results should be deemed generally conclusive in all districts, this decision would prove fallacious, because it would soon be found, that in many other cases the results were extremely different. Neither could the practical farmer derive much benefit from the experimental farm, in regard to the œconomical arrangements necessary to be adopted in the conduct of his business,—a department of agriculture which is of the very highest importance to be well understood by the practical farmer, and which is totally incompatible with the complex arrangements and ever-varying operations of an experimental farm.

Notwithstanding the truth of these remarks, the establishment of experimental farms, in different parts of the kingdom, could not fail, under proper management, to throw light on different modes of cultivation, and bring agricultors acquainted with various new and interesting facts.

When conducted under a judicious system of management, farms of this sort might ascertain the following important points in agriculture:

1st. What is the best mode of cultivating arable land?

2dly. What is the best system for the management of grass-land?

3dly. What are the most useful implements of husbandry?

4thly. What are the most profitable breed of animals, and the best and cheapest modes of feeding and fattening them? and,

5thly. What is the best plant for rendering waste or barren land productive?

EXTERNAL *Injuries*, in *farriery*, are such as happen to cattle of different denominations, as cuts, wounds, bruises, &c. It has been remarked, by Mr. Denny, that horses at large, or confined in stables, are very liable either to hurt themselves, or be injured by other animals; and in proportion to the violence of these accidents, will be the subsequent inflammation and swelling. And that, if the accident, when discovered, appears likely to prove of consequence, bleeding may be proper; but in all slight cases, local remedies only are requisite. Of this kind are the application of lead-water, or a poultice of bran and vinegar warm. But, if the injury be on the extremities, bandages may be applied, and kept constantly moist with lead-water or vinegar; or the part may be bathed with camphorated spirits. And that, in case any indolent swellings remain, as is frequently the case after violence done to the knee, hock, &c. a blister will be found the most useful application. The horse should have gentle walking exercise daily, as soon as he is sufficiently recovered.

It is added, that where the inflammation has been so considerable as to occasion the formation of matter, poultices and warm fomentations are to be used,

and continued till the abscess is in a fit state to have the matter discharged; when a large incision must be made with a lancet in the most depending part, and the wound afterwards dressed with digestive ointment spread upon tow, or some other similar application.

EXTRACT *of Lead*, in *farriery*, is a solution of litharge in strong vinegar, by boiling it gently to the consistence of a thin syrup, and, after it has stood to settle, the clear part is poured off for use. A small portion of this, diluted with a large quantity of soft water, makes what is termed the vegeto-mineral water, which is employed as a lotion, or, boiled with bread or bran, for a cataplasm. The extract is likewise combined with unctuous matters into a variety of forms. These preparations have been found of great utility in various cases of inflammation. Their application has, however, been observed to produce many of those affections of the nervous system which characterise the poisonous effects of lead taken internally in the human subject. The practitioner should, therefore, be cautious lest the too free use of it occasion similar evils to the animals whose diseases it is intended to alleviate. There is no doubt but solutions of vitriolated zinc, of alum, &c. will answer as well in many cases; and these may be safely used to any extent in most instances.

This preparation has been much extolled by Mr. Goulard, a surgeon of Montpellier in France.

EXUVIÆ, the cast-off parts or coverings of animals, and also the shells and other marine productions met with in the bowels of the earth, having been deposited there for a vast length of time, probably from once living creatures. Substances of these kinds, where they can be procured in sufficient quantities, are highly valuable as manures, and capable of extensive application, especially on all the heavier and more stiff kinds of soil.

EYE, in *farriery*, the organ of sight in an animal, or that which represents objects to the mind. The goodness or badness of the eyes of horses are circumstances in which the best judges are often mistaken: much regard has been generally paid to the clearness and transparency of them, which indeed ought to be considered; but it is not always the clearness of the eye that denotes its goodness; there are several other indications, from which the judgment must be drawn, such as the form and manner of the eye, and the parts belonging to it. The eye of an animal is, however, seldom strong and perfect, except where it is clear and bright in its appearance, and where the pupil has a proper degree of contraction on the application of light or other stimuli.

In respect to the eyes of horses, they may generally be concluded to be good where the eye-lids are thin, where the outward coat or tunicle of the eye is also thin and delicate, where the caruncle next the nose is small and dry, where the eye is transparent and sprightly, and where they have a bold resolute look, and take notice of objects without fear. On the other hand, when they move their ears backwards and forwards, and seem surprised at every noise or motion of the hand, when they raise their feet high, are uncertain in their walk or step, and are unequal in their goings, when their eyes appear full and swoln, with a fleshy circle round them, or when they are sunk or flat, or of a longish oval figure, when the outer coat is thick, and covers a great part of the eye-ball, and the glands or kernels of the eye are spongy and moist, a badness of the eyes, or a tendency to blindness, is denoted.

The chief diseases of the eyes of horses are, 1. *Ophthalmia*, or *inflammation of the tunica conjunctiva*, in which the animal's eye-lids drop, the tears run plentifully over the cheeks, and still more pass through the nasal duct, where drops of fluid may be seen at its extremity, which never are seen in the healthy state of the eye; the haw is thrown over the eye, in order to prevent the admission of the rays of light, which, in this state of the eye, would irritate it, and increase the disease. It is not unusual, however, to find the eye that was to-day very much diseased and inflamed, quite clear in the course of the next day. This phenomenon is owing to the power of restoration being in the horse so great in comparison to what it is in the human subject. According to Mr. Feron, this disease is never found in unbroken horses, but always in those that are domesticated. It is neither found in colts nor in old horses, but takes place at the age of between five and six. The reason, he thinks, is, that, at a period when the animal has ceased to grow, and may be said to have arrived at maturity, he is much more subject to plethora, and consequently to inflammatory diseases, than at any other period. It is supposed, that the great cause of ophthalmia in horses is the change of temperature to which they are exposed; not to mention the air they breathe, vitiated by their dung and urine fermenting in the stable. Hence it is that more horses with diseased eyes are found in London than in any part of the country (the cavalry excepted). Unequal exercise also contributes to produce this and almost all other inflammatory diseases; for it is very frequent to see horses exercised and ridden very violently one day, and suffered for a whole week afterwards to remain at rest. This disease, Mr. Feron says, is not to be "considered as local; for, when it is so, it is much easier of cure: but constitutional, and therefore also requiring constitutional remedies and treatment; but, unfortunately, we have not yet discovered a specific of this nature. The animal seldom perspires in this disease; and, if he does, it is in excess, which shows that the constitution is affected; and there is also a slow lingering fever. If he is bled, purged, &c. the eye first affected soon becomes clear; but, at the end of five or six weeks, the other eye becomes inflamed: this gets also clear; and, about the same period afterwards, the eye that was originally inflamed now again becomes affected, and so on periodically, till the animal is totally blind in one of them. The degree of inflammation is very various; sometimes it is so great that the iris becomes affected, and a little deposit of lymph may be observed at its edge, and also at the edges of the little glandular bodies. This does not take place in the human subject; for,

though the iris is contracted, it is in consequence of sympathising with the retina to prevent the admission of the rays of light. This deposit of lymph is most commonly at the inner angle of the iris, and at the edge of the superior glandular bodies, and it is a sure indication of a succeeding cataract and blindness; and, as it is a deposition on the iris, it is very difficult to get rid of. The cornea is sometimes as red as if it had been washed with veinous blood, and neither the iris nor the pupil can at all be seen." And it is added, that "it frequently happens that the iris appears of a yellow colour: this, however, does not indicate any disease in it, but shows an incipient disease of the cornea, which now receives more serum into its vessels than they can make transparent, because they are too much distended and enlarged to produce that effect; just as any coloured fluid will not appear transparent if contained in a glass tube of an increased diameter. These circumstances will also apply to the disease going off, as well as in its incipient state."

The following remedies have been tried at the Veterinary College, according to Boardman. "The professor has begun with bleeding from the jugular or angular veins; at the same time employing purgatives frequently repeated, at well as diuretics administered alternately with the former. After these he has tried all the medicines employed in ophthalmia of the human subject by Messrs. Wathen and Phipps, but without any degree of permanent success. The local and surgical treatment has been as follows, viz.

"1st. He has ordered scarifications to be made; and a seton to be passed through the membrana conjunctiva.

"2dly. Some of the larger vessels going to the cornea have been removed and divided with the actual cautery.

"3dly. Leeches have been applied to the conjunctiva. None of these, however, have been attended with good effect.

"4thly. Both the carotid arteries have been taken up; but even this was of no avail, since the anastomosis, which the vertebral arteries form with the carotids, prevented the intention.

"It results therefore, he thinks, that the treatment of ophthalmia in the horse is confined entirely to bleeding, purging, and diuretics; fomentations of warm water, in order to diminish the irritation from the tears that run over the cheeks; wholesome diet, and moderate but continual exercise, to increase perspiration."

2. *Cataract.*—which, according to Mr. Feron, is "the most common and general termination of this specific ophthalmia. It is nothing more than an opacity of the crystalline lens, which was before transparent; it generally becomes of a white or yellow colour, &c. and inclining to white in the circumference: sometimes the capsule of the lens becomes thickened, and even bony, &c. At other times, the lens escapes from its capsule, and adheres to the iris, which comes in contact with the cornea; the vitreous humour becomes absorbed, and the posterior part of the eye filled with lymph, the size of the eye being diminished. But if there is no lymph thrown out, then the cavity of the vitreous humour remains, and a septum is formed between it and the lens.

"When the lens or crystalline humour gets loose out of its capsule, if it does not adhere to the iris, it rolls about the eye like a marble, and produces absorption of the vitreous humour, retina, &c.

"In the human subject, an operation is performed for *extracting the cataract*, which is generally successful in giving sight to the patient: but in the horse it is useless, and should never be recommended; because the important functions of the crystalline lens must be supplied by two different sorts of glasses, convex to see near objects, and concave to see distant ones. Now it is utterly impossible to employ these so as to be of advantage to the horse; and without them vision is so confused for want of the lens, that it is much better to have the animal quite blind; for he would be continually stumbling and starting, and of course of little value to the owner. The only advantage of extracting a cataract to a horse would be when the animal is turned into the field to graze. But, beside the objection before mentioned, there are still more; for the operation is very difficult to be performed, from the retractor muscle drawing the globe into the orbit so much that we cannot get at the cornea; besides, this part is naturally much less convex than the cornea of the human subject."

It is observed by Mr. Boardman, that "Mr. Feron was enabled to perform the operation, by counteracting the action of the retractor muscle, with the assistance of a double tenaculum, which he found much better than any speculum. Still the event was without success; for, after the operation, the retractor muscle continued to draw the globe into the orbit, and the eye of course appeared less than its fellow; and the aqueous humour continually escaping, prevented the union of the divided cornea, which, from the irritation produced, inflamed, as well as the iris and all the other parts, and the bulk of the eye became very considerably diminished. The iris sometimes getting between the divided parts of the cornea prevents the escape of the aqueous humour, and the wound heals. In case of a disagreeable white cataract, or if there is lymph between the crystaline, and vitreous humours, we may, he thinks, in this case, remove or extract the lens."

3. *Matter formed by the iris*,—which is another, not unfrequent, disease of the horse's eyes. "In this case the purulent fluid gravitates to the depending part of the anterior chamber of the eye, and has a semicircular appearance, on account of the figure of the cornea, the pupil being always contracted. If this matter is not soon removed, it will, he says, by pressing on the cornea and iris, produce blindness: we ought, therefore, as soon as it is perceived, to puncture the edge of the cornea, just below the matter, with the point of a lancet, so as to allow of its escape. This appearance is almost always the forerunner of a cataract" in these animals.

4. *Gutta Serena*,—which is vulgarly called "*glass-eyes*" by farriers, as the eyes, far from be-

ing dull or disfigured, generally appear very clear and glassy. "It is, Mr. Boardman says, a much more frequent affection of the human eye than of that of the horse. The pupil is very much enlarged and dilated, in consequence of the total loss of sensibility in the retina and optic nerve; which being no longer capable of stimulating it to action, the muscular fibres contract from the centre towards the circumference, enlarging the aperture as when the perfect eye is exerting its powers to view objects in the dark. The gutta serena is supposed generally to arise from an affection of that portion of the brain immediately connected with the optic nerve; but it is more likely that the deficiency is confined to the nerve itself. Some diseases of the brain, as the staggers, or a blow on the head, will produce it. When proceeding from any of these causes, we may attempt the cure, he says, on the authority of Mr. Feron, by bleeding, purging, blistering the top of the head, and stimulating the nostrils with the vapour of vitriolic or marine acid."

5. *Watery Eyes*,—which proceeds from an increased secretion of tears, that flow down the cheeks, in consequence of the lachrymal ducts not being capable of carrying all the superfluous quantity away; or it may arise from an obstruction of the nasal duct. It is remarked by the author of the Veterinary Dictionary, that "this complaint is rather an inconvenience than a disease; and, probably, the most frequent, if not the only, cause of it may be traced to the volatile fumes, so hurtful in other respects to horses that are kept in close stables. If the secretions from the lachrymal glands become inordinate, either from this cause, or from mere debility, which may render them too obedient to common stimuli, bracing and sedative collyria, such as those prepared with saturnine or other metallic salts, seem, he thinks, to promise the greatest advantage, without having recourse to means calculated to act on the system. But when the watery eye is found to proceed from an obstruction of the ductus ad nasum, the passage must be opened by injecting a decoction of linseed, or any other glutinous injection: if this fail, the ductus ad nasum must be opened with an instrument, introduced with great dexterity from the eye down to the nose."

6. *External Injuries of the Eye*,—which often arise from inflammation produced by wounds or contusions of the eye-lid, and may extend to the eye itself; though few such accidents occasion a loss of sight, if properly treated. "In such cases, the same writer says, there is often a complete opacity for a time; but, on removing the inflammation, the cornea generally recovers its transparency. In violent accidents, indeed, where wounds have extensively divided the coats of the eye, or where the eye has been ruptured by a contusion, vision, of course, is completely and irretrievably destroyed."

The following treatment is advised by Mr. Denny, whether the inflammation arise in consequence of injuries to the eye itself, or to the eye-lids only.

In the first place, "take away four or five pints of blood from the neck-vein, and then apply the following poultice to the eye:

Take of bread, finely grated, a handful; lead-water, enough to make it of a proper consistence; add olive oil, one ounce. Mix them.

"Apply it cold; renew it several times daily; and give the following ball, with mashes of bran and warm water:

Take of Barbadoes aloes, one ounce; ginger, in powder, two drachms: Form them into a ball with treacle.

And that as a low diet is required, hay and corn must be sparingly allowed. If the inflammation does not subside by the third or fourth day, a rowel should be put under the jaw, and continued till the disease be removed.

When the ball has operated, he directs the following fever-ball to be given morning and night:

Take of Antimonial powder, one scruple; nitre, in powder, six drachms; aniseeds, half an ounce; treacle, sufficient to form the ball.

He adds, that it is not uncommon, for small specks to remain on the cornea after the inflammation is gone. "In such cases, the best application is, he says, a few drops of the tincture of opium, on lint, introduced between the eye-lids once or twice a day. This stimulates the lymphatics to absorb the lymph; which, being diffused between the coats of the eye, occasions imperfect vision."

A similar mode of treatment may be employed in similar affections of the eyes in other brute animals.

Eye, in the management of fruit-trees, implies the small bud or shoot inserted into a tree.

Eye-*Lid*, the membrane that covers and protects the eye. It is very subject to be affected by inflammation of both the acute and chronic kinds, which may be remedied by sedative or stimulant applications, according to the nature of the case.

Eye *of Pheasants*, signifies a young brood of these birds.

Eye *of a Tree*, a small pointed knot to which the leaves adhere, and from which the shoots spring forth.

EYEABLE, a provincial term used to signify the fine appearance of collections of sheep or cattle.

F.

FACTOR, in some places, as the northern parts of the island, signifies the agent or person who has the overlooking or management of an estate or farm for another.

FAGGOT, a bundle of small wood tied up together closely. They are made up from the cuttings or thinnings of coppices or hedges, and, in many districts, sold to the bakers.

FALL, a measure of land, the same as perch.

FALLING-*Sickness*. See *Epilepsy*.

FALLOW, such land as has been repeatedly ploughed over, and exposed to the influence of the atmosphere, for the purpose of rendering it mellow and clear from weeds, not being sown, but left to rest after the tillage.

Fallows have different names given to them, and are of different kinds, according to the purposes for which they are intended, and the manner in which they are made.—A *naked fallow* is that in which the ground is ploughed and harrowed at suitable intervals for several times, according to the kind of crop that is ultimately to be grown, but without being sown till it has laid for some length of time afterwards.—A *green* fallow is where the land has been rendered mellow and clear from weeds by means of some kind of green crop, such as turnips, peas, tares, potatoes, &c. In this mode of fallowing, no time is lost by the land being left idle, or in an unproductive state. They are also sometimes distinguished by the season of the year in which the business is chiefly or wholly performed, hence we have *summer* and *winter* fallows; and likewise from its being in some cases only done in a partial manner we have *bastard* fallows. Fallows are also named after particular crops, as wheat, turnip, and potatoe fallows.

FALLOWING, the art or practice of preparing lands by repeated ploughing, harrowing, or other means, so as to render them suitable for the growth of different grain-crops. This method of turning over or stirring the land during the autumnal, spring, and summer seasons, in order to bring the soil into a proper condition for producing plentiful crops, is a practice that was had recourse to at a very early period. It was probably first introduced and adopted as a means of bringing the more coarse kinds of arable grounds into a state fit for the production of grain-crops, and afterwards employed for the purpose of keeping such as had been brought into that state free from those vegetable productions which have a tendency to injure and destroy such crops.

By the frequent turning over and exposing of new surfaces of the soil to the operation and influence of the atmosphere, various changes are effected in the earthy particles of land, as well as in the substances with which they are impregnated. It has been observed by a philosophical writer, that "the heavier or more earthy particles of the land, by being under different circumstances of the air and seasons thus frequently stirred and turned over, are so effectually divided or separated from each other, and broken down, that even in most of the stiffer sorts of ground, as well as those of the lighter kinds, there is a degree of pulverisation and mellowness effected that could scarcely have been induced by any other means; in consequence of which, the portions of vegetable matter that are present, and that may have been reduced into the carbonaceous state, with the calcareous, the argillaceous, and other earthy ingredients, and such metallic substances as may exist in the condition of oxyds or calces, become so uniformly and so extensively blended and incorporated, and the manures that are afterwards applied so minutely intermixed with them, that the fibrous roots of the growing crops, of whatever nature they may be, are enabled to penetrate and extend themselves more fully, and of course to draw more regular and varied, as well as more abundant, supplies of nourishment" from the land. And that farther, "on account of the extreme division and pulverisation that takes place, and the great irregularity of surface which is produced in this way, the dews and light refreshing rains that are so frequently occurring in the early spring months, are more capable of being admitted and diffused through and detained in the hollows and interstices of the ground, and thus to contribute powerfully to the support of the crops in the more incipient stages of vegetation." Likewise "by the repeated turning-in and destruction of different sorts of plants of the weed kind, much vegetable mucilaginous and saccharine matter may also be added, as well as the land improved by the putrefactive fermentation that must from these causes be constantly taking place," and going on in it.

Other ways in which advantages may be derived from the repeated turning over and breaking down the particles of soils, have been suggested by Dr. Darwin, such, according to the statement of the author of Practical Agriculture, as "from much of the atmospheric air being by such methods of husbandry blended with the fine particles of the soils, and detained in the numerous hollows and cavities formed.

by such degrees of pulverisation, a larger proportion of oxygen may be supplied, which by its union with the carbon and other inflammable materials that are mostly contained in soils, may produce the carbonic or other acids, according to the circumstances of the cases, in greater abundance, and in this manner aid the growth of vegetables in a high degree. And as the water or moisture that is included in large quantities in the pores of soils in such powdery states, may undergo the process of decomposition more fully, by coming more minutely in contact with the portions of atmospheric air that are covered up and imprisoned with it in them, the supplies of ammonia or volatile alkali, by the combination of its hydrogen with azote, may be more regular and more copious, as well as those of nitre, by the more complete union of its superabundant oxygen with some other portion of the abounding nitrogen or azote of such air." And likewise, that "as the atmospheric air consists, or is constituted of oxygen, azote, and the fluid matter of heat, if the heat that causes them to exist uncombined in the form of gasses be drawn away from them by some other material while they are confined in the cavities of the soil, they may by their nearer approach to each other combine so as to produce nitrous acid; or the oxygen, in its fluid state, not in its aërial one, may more readily unite with carbon, and thus constitute a fluid, not an aërial carbonic acid, which is supposed to be of great utility in promoting the growth of plants. And further, that if any process of the putrefactive kind be going on where atmospheric air is in this way confined in the interstices of the soil, and by the deprivation of its heat is converted from a gas to a fluid, the azote may combine with the hydrogen of the decomposing water, or contribute to decompose it, and in this manner form volatile alkali, which, like nitrous acid, may, either during the process of its formation, or after that has been completed, be of very material utility in promoting vegetation, while at the same time the oxygen afforded by the decomposing water may, like that of the atmosphere, contribute to the production of the carbonic, nitrous, or phosphoric acids; and in this way render carbon, phosphorus, and the basis of nitre, capable of being taken up by the absorbent roots of growing plants. From the great diminution of bulk that has been found from experiment to take place where atmospheric air is confined in contact with water, it is conceived that there may be a decomposition of both the water and the air, and a production of both ammonia and nitrous acid, which are known to be beneficial in promoting the vegetation" or growth of plants as crops. It is therefore conceived that the practice of fallowing in different instances may be highly useful in various ways, though many objections have been urged against it by writers on agriculture; but at the same time it may be more beneficial in some sorts of soil than in others; as those of the more stiff, heavy, adhesive, clayey kinds, where the bottom is subject to moisture; while in those of the more light, friable, and mellow descriptions, where full crops of various sorts of luxuriant vegetables can be grown, it will seldom be necessary, as they may be easily kept in a proper condition by such fallow-crops.

And one great purpose of the fallowing system is, Mr. Donaldson observes, to destroy the weeds, which, in consequence of previous mismanagement, and of over-cropping, have increased to such a degree as to render cultivation for grain no longer profitable. Land being allowed to rest for a season from yielding a crop, and being repeatedly ploughed, the soil exposed to the influence of the different seasons, and at the same time completely pulverised, its fertility is again somewhat restored, so that, by the application of a smaller portion of manure than would be otherwise necessary, it is rendered fit for again producing valuable crops of grain or grass. It is, he says, universally acknowledged, that all soils, even those naturally the most fertile, are capable of being rendered unproductive by constant and severe cropping, and that the more improper the modes of cropping are, the sooner, and the more certainly, will a comparative barrenness ensue. Hence the propriety of fallowing, where imperfect modes of culture are adopted. Fallowing, in what may be called the infancy of improvements in agriculture, is also, he thinks, essentially necessary. If land be greatly exhausted, no matter by what sort of previous mismanagement, fallowing is, he conceives, the most expeditious, the most effectual, and, every thing considered, the least expensive method that can be adopted for restoring its fertility, and rendering it productive. It is the most expeditious, because it is completely done in the course of one season; whereas several years of culture, and a great additional quantity of manure, would be requisite, were any other less effectual mode of tillage adopted. It is the most effectual, because the farmer has it in his power to destroy every weed, to turn over and expose the soil to the influence of the weather in the different seasons, and also to level and straighten the ridges, drain the land, and remove every obstruction to the introduction of better modes of husbandry, none of which could be so conveniently or effectually performed between the harvest of one year and the seed-time of the next. Fallowing is also, he says, upon the whole, the least expensive method by which the fertility of land greatly exhausted can be restored, and the only one that can be adopted with a certainty of success, for the removal of every obstacle to the introduction of more perfect agriculture. Manure operates more powerfully when applied to a field that has been properly summer-fallowed than when laid on one that has been long under an improper course of cropping. The returns, after fallowing, will be to a certainty greater; and, therefore, although the actual expense of fallowing is considerable, yet the crop that succeeds is so much greater as to counterbalance that expense, while those that follow, if properly adapted to the soil, will yield the farmer a proper compensation for his extra trouble and expense. In the above statement, he observes, however, that he had chiefly in his eye the practice

of fallowing, as recently adopted in the southern parts of Scotland, and the principles on which the farmers regulate their conduct, when new and better modes of culture became general.

It is remarked by Mr. Headrick, in the second volume of Communications to the Board of Agriculture, that many farmers regard fallowing, as the greatest improvement that ever was introduced into the agricultural art; by others it is either unknown, or is despised as an unnecessary waste of labour, and a sacrifice of the produce of the land. Much of the contrariety of opinion which prevails on this subject may, he thinks, be accounted for, from the quality of the soil on which the farmer operates, or from his local situation. Strong clays require a more frequent repetition of fallow than those soils that are dry and friable, from containing a great proportion of sand. In those districts where excessive rains abound during summer, it is seldom convenient for the farmer to be encumbered with too great a proportion of fallow, as it is often impossible to get it properly wrought, before the land is turned into a mire, if the finest parts of the soil be not washed away. In such situations green crops, adapted to the quality of the soil, are, in general, the most eligible mode of fallowing. As in such districts pasturage ought to be the principal object, so this mode of fallowing is calculated to provide for the wants of the live-stock in winter as well as in summer. There is no soil or situation, he supposes, where naked fallowing might not be rendered less frequently necessary, if not wholly superseded, by adopting a proper rotation of crops. Were a drilled green or pulse-crop interposed between every two corn-crops, the land would always, he says, be kept clean and in fine tilth, and a much greater value would be extracted from the same quantity of manure. As the quality of the soil ought ever to be considered in deciding the species of fallow for which it is best adapted, so the quality of the soil ought also, he thinks, to determine the mode by which the fallowing ought to be conducted. Some soils ought always to be turned up before winter, that their parts may be split and pulverized by the frost; others should not be stirred until spring, as excessive pulverization renders them liable to become miry with rain, which chills the crop, and they consolidate into a hard mass at the approach of drought. Thus it is more convenient to have such soils rather broken into small pieces than reduced to a fine powder; but where the object in view is a drilled crop, he believes it is always advantageous to turn over the land before winter, or even to give it a stirring or two during that season, because working it in drills afterwards prevents the effects already stated.

For land already in cultivation, the great uses of fallow are, he conceives, to reduce or preserve the land in a state of fine tilth, to clean it of weeds, and, by turning it up to the air, to cause a more perfect putrefaction of the animal and vegetable matter it may contain. This last effect is so clearly ascertained, that the most experienced farmers have assured him, that land which has been repeatedly dunged has been found to yield a much better crop, in consequence of a fallow without dung, than from a complete dose of dung without a fallow, and this too after the productive power of the land had been much exhausted by cropping. But for land that is to be reclaimed from a natural state, or from a rude and imperfect state of cultivation, a fallow is always indispensably necessary, for various reasons, and particularly those of affording a convenient opportunity to level the inequalities, and to lay the land in the most proper form for future cultivation.

It is stated by the intelligent authors of the Agricultural Survey of the County of Northumberland, that the practice of making naked fallows on all kinds of soils, once in three or four years, was general through that county, till the introduction of turnips; in a few years the fallows of the dry lands were covered with this valuable plant. On such other soils as were found improper for this root, the naked fallows still prevail, with an almost universal opinion, that it is absolutely necessary to the fertility of the land; yet there are some few, they say, who dare to doubt this long-established doctrine, and presume to think that naked fallows might be dispensed with in many situations, by cultivating leguminous crops, drilled at wide intervals, to admit being ploughed or horse-hoed between: to which, if proper hand-hoeings be added, the land will be as well prepared for wheat, as if it had been a complete naked fallow. This is not, they say, advanced on speculation or theory; instances can be produced, where no naked fallows have been made on fields of strong loam for twelve years, yet they are as clear of quickens, couch-grass, or other pernicious weeds, as any fields in the district that have been under naked fallow two or three times in the same period. It may, however, be necessary to observe, they think, that, previous to the adoption of this system, the land was cleared of quicken, or couch-grass, by a complete summer-fallowing.

But though they are diffident in giving a decided opinion in respect to the necessity of fallowing, yet, from observations made on the above facts, they cannot help being inclined to think that the quantity of naked fallow might be very much reduced, and in another century, they suppose, will probably be totally abolished, if no fortuitous circumstances arise to check the exertions and spirit for improvement, which have been so prevalent of late years, and so generally diffused through that district.

There is no question at all of the merit of fallowing, Mr. Young thinks, in his Survey of the County of Suffolk, when compared with bad courses of crops. If the husbandry is not correct in this respect, the fallowist will certainly, he says, be a much better farmer than his neighbours. But there are courses which will clean the foulest land as well as any summer fallow, by means of plants which admit all the tillage of a summer fallow. Cabbages are not planted before June or July: winter tares

admit three months tillage, if tillage is wanted. Beans well cultivated will preserve land clean, which has been cleaned by cabbages. And, in any case, two successive hoeing crops are effective in giving positive cleanness. These observations, says he, are not theory, they are practice; and it is high time that mankind should be well persuaded, that the right quantity of cattle and sheep cannot be kept on a farm, if the fallows of the old system are not made to contribute to their support.

And in the Report of the County of Mid-Lothian, it is stated, that fallowing is practised there, not so much as making part of a rotation, as from other circumstances, which render it sometimes necessary. Thus, when lands are rendered foul, from the occurrence of a bad season, or barren, from too frequent repetition of exhausting crops, summer fallow is introduced as a corrective, and its effects are always salutary. On light or dry lands, however, it is seldom found necessary to fallow; for these can be got into good order for a crop of potatoes, or of barley, or of turnip; or even more early in the season, for beans and peas: but heavy or wet lands are not so pliable; and although it is clearly possible to labour them also, without fallowing, yet it is found to be more profitable to have recourse from time to time to that expedient, and its operation is generally more effective and lasting on such soils, so that it is seldom necessary to be repeated oftener than once in seven years.

It is asserted by the author of the New Farmer's Calendar, that the practice of fallowing, the miserable substitute of former times for manure and the hoe-culture, can be no longer necessary on *any* soils, under the present improved state of husbandry. In those parts where judicious cropping has been substituted to fallows, he says, every species of product, including the rental, has experienced a wonderful increase, to the certain emolument of all parties concerned, the landlord, the tenant, and the public. The same kind of land in all respects, whether rich or poor, has been proved, in numberless instances, equally or more fruitful under constant crops than under the fallowing system, including those particular species of soil which it was pretended could never be successfully tilled without fallows. How often, says he, does it happen, that upon these very soils an enlightened cultivator shall be found cropping his lands according to the improved practice, and making larger crops of wheat than the surrounding fallowists! Upon the self-same soil, parted but by the hedge, one man shall make an expensive fallow for wheat, and gain two quarters and a half; his neighbour shall also obtain the same quantity of wheat, after a fallow-crop of cabbages or carrots, the acreable profit of which shall far exceed that of the wheat itself, and his land shall be at the same time left in the best heart and cleanest tilth. He speaks, he says, of facts, which he has himself often witnessed; and, were proofs necessary, he could fill his book with them, drawn from the most authentic records. The advocates for fallowing within his knowledge, and he has reason to believe in general, have contented themselves with mere assertions of the superiority of their practice, without ever once deigning to make trial of any other, or with making only a few desultory and ill-conducted essays; after which they have again relapsed, unconvincing, unconvinced, and unimproved, into their old habits. By indolent men like these, and by landed gentlemen, who are so ill advised as to commit the management and the letting their farms to persons totally ignorant of any principle of agriculture, is, he says, the vexatious and unprofitable system of fallowing perpetuated. There seems ever to have been, he thinks, a striking deficiency, both of solid argument and experimental proof, for the necessity of fallows. The fallowists have, in his opinion, contented themselves with simply asserting, that their lands will not do without rest, and with exclaiming against innovation and new-fangled practice. If they have brought forth any arguments at all, those have been generally of that well-known class which men are wont to use in the service of a favourite hypothesis they have previously determined to support. It has, he conceives, been taken for granted, and with a confidence such a notion never merited, that the earth, like a system of animal organization, stands in need of rest, and that it may be totally exhausted by the action of perpetual vegetation; a notion which the earth herself, by her constant and invariable habits, has saved us the trouble to refute. It may be very properly demanded of fallowists, how it happens, that a defect of this singular kind should inhere in their lands exclusively? and why the poorest lands in foreign countries, as well as our own, should prosper under continual cropping? Whence arises the difference between their farms and their gardens? and why do the latter never stand in any need of respite, but produce exuberantly under perpetual seeding?—They are well manured and well tilled. Should the garden-culture be rejected as a parallel example, from its presumed superiority, he insists it is entirely without reason; for the open field has the advantage, both in point of air, and even the possibility of superior tillage from the improved implements and increased population of the present times. The earth is, he says, destined by nature to an everlasting round of vegetation; and, whilst confined to her spontaneous productions, requires no assistance from the hand of man. The seeds of these productions she possesses in her own bowels; and the waste and loss of substance she has sustained are amply returned to her in their falling and putrid remains, and in the rains, dews, and fat vapours of her atmosphere. Thus, production, maturity, corruption, and re-production, run in a necessary and everlasting circle. But if more be required than the earth would spontaneously produce, and the substance itself be withdrawn from the soil which produced it, an artificial amends must be made for the consequent exhaustion: hence the use of tillage and manure. This amends, however, being made to the necessary amount, the vegetable process will go on unimpeded, and the land continue to produce

for ever, without demanding truce or respite. Experiences of a date too ancient for chronology to ascertain have, he says, evinced the truth of this theory, on soils of every possible description.—Land, then, of a quality however inferior, can never want to be fallowed under the idea of giving it rest, which it will at the instant reject by spontaneous labour, to produce a crop of weeds; and as it must and will produce something, that something had surely better be such as will repay the expense of culture. But the truth is, that, excluding the idea of rest, the general system of tillage is so defective, and the operation of that most useful and necessary implement the hoe so much neglected, that, in the course of two or three crops, the farmer finds himself totally at a stand—he has been painfully and foolishly cultivating weeds as well as corn; the former have so far occupied and exhausted his land, as no longer to leave either space or nourishment for a crop of corn sufficient to defray the attendant expense, exclusive of all expectation of profit. He must, indeed, in this case, have recourse to a fallow, as the only method now left to extirpate a part of the weeds, that he may again crop his land; and this measure is at the expense of a year's rent, taxes, and labour, to fall as a surcharge on the product of the succeeding crops. That such surcharge is totally thrown away, and a positive loss to all parties is, he contends, irrefragably proved by the new practice; and if a landlord should suppose that he spares his lands, by making a covenant for fallows, he also ought to take into the account, that, unless he permits the new practice, he can have no title to expect a new rent.

After supposing the following observations, which are contained in the Reports of Staffordshire and Kent, to be erroneous, namely, that "fallowing for wheat, on cold, wet, or strong lands, and on all such as are unfit for turnips, is absolutely necessary; and that he who shall attempt to manage such land without fallowing will have occasion to repent his mistake;"—"and as the mixed soils now in question, which are too moist for turnips, have a particular propensity to the protection of these (root) grasses, summer fallowing becomes absolutely necessary, and every attempt to crop without it, for any length of time, on such land, has terminated to the injury of the land, and the loss of the occupier,"—he contends, that, if these farmers will be at the pains to search out of their own counties, they may find numerous practical refutations of the above doctrines, in the very converse of which he really believes the truth to reside. He has never observed couch to be eradicated by fallowing; a portion only is destroyed, and a sufficient quantity of roots left to produce a crop, which will speedily demand another fallow, and so on for ever. Regular periodical fallows may, in truth, he thinks, be styled the nurseries and hot-beds of couch, since, on lands subject to the practice, we ever see the greatest quantity of it. Not that he entirely agrees with the too sanguine advocates of the hoe, that it will, of itself, entirely root out couch-grass; at best, such would be a long and tedious method, at which, he says, even Tull himself hesitated. Nevertheless, after a good dragging, and burning the roots, during a month or two of dry weather, to the hoe only we must look for their gradual and total extinction; and this method he has never known to fail in the worst possible cases of couch, colt's-foot, and *id genus omne*; with the reserve, however, that the lands must never be withdrawn from the hoe-culture, whatever be the crop, until the enemy appear to be totally extinct, which will seldom be delayed beyond the third year. It seems singular to admit, that fallowing may be superseded by turnips, and yet not by cabbages and beans, the appropriate hoe-crops of strong lands; surely the latter will bear constant tillage, at least equally well with the light and weak. But whilst he contends that the earth requires no rest, but rather exercise and good nourishment, he would not thence be understood that she derives no benefit from rest: all experience declares the contrary; her spontaneous growth being returned to her bosom, this also laid open by tillage to the absorption of the fattening dews, there can be no question but she is so nourished and restored. All intended to be proved is, that the price is infinitely too high for the benefit received, and which, in truth, to its fullest extent, may be otherwise obtained gratis, and even with a premium annexed. Nor is he at all prepared to say, that those styled ameliorating crops, whether carrots, turnips, cabbages, grasses, or what not, are such, in the simple and restricted sense of the word, that they are really the vehicles of nourishment to the earth, like a fallow, or, that the putrid fermentation occasioned by their shade, enriches, since, if it really have that effect, themselves are extracting the benefit of it.—No, all vegetable productions carried off the land, although not in equal degrees, detract, he says, from the strength of the soil, which may be impoverished by the scythe as well as the sickle; yet grass surely exhausts it the least. Those plants abounding most in vegetable gluten, in weight and substance, are the greatest exhausters: at the head of them, undoubtedly, wheat ought to be placed; potatoes, perhaps, next. Crops, then, can only be said to be ameliorating, on the score of their being hoed, and of a considerable part of their produce being returned to the land, in the dung of the animals which they feed. Omit the hoe, and sell the crop, and, instead of amelioration, you would soon, he thinks, find galloping consumption; and then, if in want of a convenient phrase, you might say, your land was tired of such or such a crop. Even the best tillage under the fallow-system, he supposes, stands self-convicted of deficiency, since it needs the invariable repetition of that expensive aid; it evinces a defect of crops for the support of cattle, of consequence a defect of manure and of hoe-tillage. If the sowing of white corn by broad-cast must be persisted in, there is no possibility of keeping the land clean (generally speaking) but by the intermixture, in due course, of pulse-crops which are hoed; with the aid of

which, and a strict attention to hand-hoeing and weeding the broad-cast corn, the necessity of fallowing will be for ever precluded. It will be understood, that a summer's respite is necessary at first, in order to clear the soil of root-weeds; and afterwards the usual intervals between the crops, the weather being dry, will afford opportunities of again using the drag, or cultivator, to the same end. These occasions always being diligently laid hold of, the roots will soon be totally destroyed. As to the seed-weeds, contrary to the common custom of farmers, those ought to be encouraged, by all possible means of pulverization, to make their appearance, that they may be drawn or cut off previous to their bloom. Various circumstances in tillage may induce the necessity of an occasional winter-fallow, which, by the land being laid up clean, will always be beneficial.

The practical author of Modern Agriculture, however, observes, that the practice of fallowing may no doubt be adopted with propriety in some cases, while a slavish adherence to it in every instance would be highly improper. Where the practice of naked fallowing is thought necessary to be performed, the ordinary method of proceeding is for the land to be first ploughed in autumn, a second time when the barley seed-season is over, and two or three times, or oftener, afterwards, as circumstances may render necessary, it being well broken and reduced by means of harrowing in the intervals. But, in many districts, seldom more than three ploughings are given to lands in a course of summer fallow; one in autumn, or early in the spring; another during the summer; and afterwards the seed-furrow. This preparation appears, however, he says, extremely defective; as in an ordinary season it is scarcely possible, that, with so few ploughings, either the root or seed-weeds can be completely destroyed; and when the summer happens to be wet or rainy, the lands under such management must certainly be in a very bad state for receiving the seed. When lime or marl is applied, it should be done in the month of July or beginning of August. The land should then be ploughed very shallow; and before the last ploughing for the seed is given, farm-yard dung, at the rate of twenty or twenty-five cart-loads, (from 15 to 18 cwt. each) should be allowed to each statute acre. The dung should be ploughed in as soon as possible after it is spread on the field, and the seed sown with the first convenience thereafter.

But in some districts a rather different method is followed. In Mid-Lothian in Scotland, as observed in the Survey of that district, the first ploughing for summer-fallow is commonly made early in the spring—not so much from a conviction that it is better then than before winter, as from a regard to the accommodation of the labour to the other crops —it being esteemed to be more requisite that the barley, the potatoe, or other spring crop-lands, should have the first furrow, called there *winter-fallow*, immediately after the autumn; and, as the winter generally sets in early, it is not always in the power of the farmer to get the summer fallow-ground ploughed at that time too: it is, of course, put off to the commencement of the spring, and is generally the first ploughed land after the winter storm, when the ground would be too wet to receive a seed-furrow to any crop; and thus it becomes more œconomical in the labour, as no other tillage could be carried on at the time. The second furrow is given after the barley-seeding is finished, in the last week of May, or beginning of June. By this time a crop of weeds has made its appearance, and of course is ploughed under and destroyed. In a fortnight afterwards the land is harrowed, and with that operation another crop of weeds is put an end to. The third ploughing takes place about the first of July; the fourth, about the first of August; and the last, about the first of September; at all of which, crops of annual weeds are destroyed, as are likewise intermediate crops at the different harrowings which take place regularly between the ploughings; and last of all about the middle of September, or first of October, when the seed is sown: and even then a great crop of annual weeds remains to be rooted up by the harrows; so that during the whole process, no fewer than eight different crops of these weeds are destroyed, as well as all the root-weeds, which are from time to time picked carefully from off the land and burnt—an advantage hardly attainable by any drill-crop whatever, besides the more effectual pulverization of the soil, from the several cross-ploughings and harrowings that are given.

When dung is applied, it is generally laid on about the end of August, immediately after the last ploughing; but in many cases, where the soil is naturally good, it is forborne till the second ensuing crop, as it is found that the first crop is in danger of being too rank, and of course lodged before it is ripe, if the land is dunged the same year that it is in summer fallow; and when one reflects on the many crops of weeds that are ploughed under, or rooted up, and thus consigned to putrefaction during the process of fallowing, it should not appear surprising that dung in this case should be unnecessary. Indeed, the strongest crops of wheat that the author has yet seen, have been on land summer-fallowed without dung.

In the second volume of Letters and Papers of the Bath Agricultural Society, some observations are made by a Dorsetshire farmer, which seem to merit attention, as being equally applicable, whether it be proposed to winter-fallow for barley, or to winter and summer-fallow as a preparation for wheat. When the land is ploughed after harvest, which is recommended to be done as deep as possible, no time should, he says, be lost in rendering this new-turned up soil as fine as possible, by harrowing; as he is convinced, by repeated experiments, close observation, and plain reasoning on known facts, that lands that are made fine before the sharp frost and winter rains come on, will receive a much larger share of their influence than any other. If the land be left in a rough state, there is seldom time for the rains and frost to affect more than the outside of the

large clods or lumps. The outside will indeed be pulverised, but the middle of the lumps, whenever they are large, will be found nearly in the same hard stiff state, as when turned up by the plough. Hence it must appear to every one, that the benefit of air, winter rains, and frosts, on lands thus left, is partial; and the consequence is, that harrowing it in the spring, when these are over, is too late for its receiving the benefit which would have accrued from them, and the power of vegetation is not so vigorous. But to make winter-fallows as fine as they can be in autumn, and then ridge them up in that pulverised state, is acting most agreeably to nature. The greatest possible quantity of surface is by this means exposed to the atmosphere; and the land is left in a state wherein the rains and the frosts are most easily admissible. They will then penetrate and enrich the whole mass to a greater degree.

If the frost penetrates a quantity of earth, formed into a large hard clod, partially, on account of its bulk and hardness (which is always found to be the case), it is evident, that the same clod, broken into four parts, would be thereby penetrated four times as much; or, in other words, four times the quantity of earth would be affected by it, and on a thaw be pulverised. For we find, that, after the breaking up of a severe frost, all the small clods crumble easily into powder; while the large ones are only made smaller, by the crumbling off of their surfaces to a certain depth.

Such are the reasons assigned for differing in the mode of managing fallows from the generally established practice. And they ought, Mr. Donaldson thinks, to have considerable weight, particularly with those who cultivate soils of a strong and adhesive nature; as the success of the experiment made by the writer is, he thinks, a sufficient inducement to others to follow his example. It is this: He left one half of a field of ten acres, as nearly of an equal quality as possible, in the rough state after ploughing; while the other was made very fine, by harrowing and beating in pieces any large hard clods which the harrows could not break. In the following spring, it is observed, that part which had been harrowed was much finer, without any additional labour, than he could render the other by repeated harrowings. This he accounts for, by remarking, that the rain and frost not having penetrated the middle of the large clods, they had received no benefit therefrom, and were as hard as bricks, being only lessened in size. The whole field was sown with barley, and nine pounds of broad-clover, immediately afterwards. On harvesting the crop, he kept that of the one half of the field separate from the other. The part which had not been harrowed in autumn produced twenty-four bushels the acre; the other thirty-one, and the quality of the grain much superior. The crop of clover, the following year, was equally in favour of the new method of fallowing; being heavier by near half a ton on the acre.

In the second volume of Communications to the Board of Agriculture, Mr. Headrick speaks of a mode of fallowing by drills, invented by Mr. John M'Kenzie, at Glasgow, which, he says, is certainly the best of any yet attempted by the plough, either for levelling cold-bottomed ridges, or for pulverising stubborn clay-soils already in a level state: but it requires considerable dexterity in the ploughman. In performing this operation, the water-furrows, he observes, are first gone round, and ploughed in on each side, so as to form a drill, when the third fur-slice from the rut thus made, on each side, is raised, and thrown upon the second: this a skilful ploughman can do by his eye with great exactness; but if he cannot trust his eye, he may have a cross spar nailed on the beam of his plough, to mark out the distance from the former rut, at which a slice ought to be raised. As the plough only stirs a third of the land by this first operation, it may go over about three acres in one day, laying it all dry, and in a condition to be fallowed ever after, in the wettest weather that cattle can work, without any danger of poaching. After the land is thus marked out, the cattle, ever after, walk in the ruts between the drills, and hence their feet never poach the stirred land. We have then, says he, got the third fur-slice, from the rut at which the operation commenced, raised and laid upon the second, while the first and second remain unstirred, and the first is also uncovered. The plough, in its second passage, throws the first slice upon the back of the third, previously laid upon the top of the second. This converts all the land into red earth, and the third passage of the plough stirs the remaining second fur-slice with the third that rests upon it, throwing them in the same direction. Thus all the land is stirred, and assumes the appearance of three-furred drills, the equality and neatness of which depend much upon the accuracy of the first operation in marking them out. The land may now be wrought either backwards or forwards, as may be necessary to bring it to a complete level, the horses all the while walking in the bottoms of the ruts between the drills.

At *fig.* 1. *pl.* XXXIII, *aa*, is the section of a ridge to be levelled, or, if the land be already level, it is a bout or stretch of land that has undergone the first operation of drill-fallow. If it be a ridge, the water-furrows *a a* are first ploughed in, so as to form single-bout drills; then the third fur-slice from the rut on each side is raised by the plough, and laid upon the second, and this is continued until the whole ridge or stretch is marked out. This lays the land perfectly dry, having a rut at every third furrow. *Fig.* 2. is the same land, after being twice gone through with the plough. In this second operation the fur-slice, No. 1, is stirred, and all the land becomes red earth; because, though No. 2. yet remains unstirred, it was previously covered by No. 3. *Fig.* 3. is the same land after the third ploughing. In this No. 2. is stirred, and the whole soil is now moved by the plough. The land now assumes the appearance of three-furred drills. If it be now level, the drills may be reduced by a brake-harrow,

and marked out again in some other direction, so as to have the effect of cross-ploughing; only the direction must be such, that the water may be discharged from them. In this way the land may be ploughed in various directions, and wrought in drills during the whole course of a fallow. This mode of fallow, it is observed, causes a violent vegetation of weeds, because, by exposing more surface to the air, it brings more of their seeds within that distance from the atmospherical influence, where their vegetation commences. By stirring only one fur-slice out of three at a time, every slice has full opportunity of meliorating by the influence of sun and air before another is thrown upon its back; it also renders the fallow wholly independent of excessive rains, which often render fallowing impracticable. When the land is brought to a perfect level, the weeds should be destroyed by a strong brake-harrow dragged across the drills. This will reduce the land to a smooth surface, in which state it may be allowed to remain until more weeds spring up: but if excessive rains should surprise the land in this state, a plough can be sent through to mark out new drills as before, which will render the whole dry. In fallowing, he says, cross-ploughing is essentially requisite, to cut the roots of weeds in an opposite direction, and to present new surfaces of the soil to the air. Now, by this mode of fallow, cross-ploughing can be effected with greater advantage by drills crossing the former, and marked out after the land is laid smooth by the brake: such drills should always be so drawn as to discharge the water. Thus a field may be ploughed in several different directions, always keeping it in drills, and remain, independent of the weather. After land is cross-ploughed in the ordinary way, it often happens that excessive rains render it a perfect mire, and it is frequently unworkable during that season. In the fallow by drills, this, he thinks, can have no place; and should the weather be too wet, at the time it comes to be ridged, to admit of smoothing the drills, the ridges can be formed of a certain number of drills thrown together. In executing this mode of fallow, care should, he says, be taken always to make the furrows clean, so that no clods, or earth, may fall back and cause water to stagnate in the ruts. When very high ridges are suddenly levelled by this mode of fallow, it is obvious that the good soil will be buried down, as happens in every mode of levelling with the plough; but the fresh soil that is turned up, being brought in succession within the influence of the atmosphere, and always worked in drills, is much sooner meliorated than by the method of close ploughing. If, however, the ridges be very high, it is safest to split and reduce them considerably in the course of cropping, previous to their being effectually levelled. When the levelling at last commences, it is proper to get through as much of it as possible before winter, that the new soil which is turned up may receive the benefit of the frost. With these precautions, high ridges levelled by a drill-fallow will discover no inequality in their subsequent fertility. It is hardly necessary to observe, that in all modes of levelling high ridges, the old water-furrows should be raised somewhat higher than the old crowns of the ridges; as the soil in the former, being very loose, subsides, and if not in sufficient quantity would again become a hollow.

In the corrected Report of the State of Husbandry in the County of Hertford, the able writer remarks, that "the fallow-system, except in a very small district, and in open fields, is not much pursued. Wherever turnips can be sown, we find them; and consequently fallows, in a county containing but little real clay, are confined, as they ought to be, to the most difficult and impracticable soils. The observation must not, however, he says, be taken as universal; for in every part of the county they accidentally take place, when land is got, by ill management, so foul as to make a complete fallow more advisable than turnips, as the means of cleaning it."

But in the original Report, it is observed, that "while weeds continue to grow and increase in the best cultivated lands, fallowing will be practised in Hertfordshire and elsewhere, where farming is understood, till a substitute less expensive, and equally successful, in destroying weeds, is discovered. Here the fallows generally succeed the crops of oats, and are thus made: the land is ploughed up in the autumn, to be mellowed by the winter frosts, and lies in that state till the Lent corn is sown in the succeeding spring; it is then ploughed again, and, if full of couch and black-grass, torn to pieces with harrows, and the couch, &c. collected in heaps, and burnt; it then remains untouched, till the seeds of the weeds therein, or the greatest part of them, have vegetated; when it is ploughed again, and harrowed, if necessary, and the season will permit, and the remaining couch collected and burnt. The last ploughing is the most important, and should be made a short time before the crop of wheat is sown, when all the remaining seeds of weeds have vegetated, and before any of them have seeded; the grain then sown and well harrowed in, will have the start of the weeds, thus as much destroyed as possible; and a spring-dressing, if necessary, will enable it to keep them effectually under. Fallowing thus made in favourable seasons, renders fallowing in future less necessary."

It is further remarked, that, in many parts of the Lothians, they have a practice somewhat similar to this mode of fallow, of ribbing the land that is intended for barley before winter sets in. This is done by laying one fur-slice upon another, which remains unstirred, and it divides the whole land into very narrow drills. These keep it perfectly dry during winter, and admit the frost to the bottom of the soil. On clay-lands, and such as have a cold bottom, this is found to be very beneficial, for barley does not thrive on such soils unless they be finely pulverised.

This mode of fallowing is probably best adapted to the bringing of such lands as have been in the state of waste, into a condition fit for the growth of grain-crops.

FALLOW-CLEANSING-*Machine*, an instrument invented, for the purpose of rendering fallows clean from couch and other kinds of weeds, by Mr. Aaron Ogden, a smith, at Ashton-under-Line, near Manchester, in Lancashire.

The introduction of green crops, in order to prevent the necessity of fallowing, has rendered the use of implements of this nature much less frequent than formerly. The machine is represented at *fig.* 4, *pl.* XXXIII, where *a a* is the frame; *b* the first roller; *c* the second ditto, in which last are two cranks to move the arms *d d*, which work the rake upon the directors fixed on the plank *e*. The under side of the lower ends, or shares, of these directors is sharp, to cut the clods, and let them come on the upper side. Each alternate heel of the share is longer than the intermediate one, that they may not have more than one half to cut at once. At the back of the plank *e* are two screws to let it loose, that the directors may be set higher or lower. The shares are to penetrate the ground two or three inches, to raise the couch and other weeds, till the rake *i i* fetches them into the cart *h*, where a man must be ready with a muck-hook to clear them backward when gathered. In the rake *i* are teeth for every space of the directors, that stones, &c. may be gathered without damage. *k k* are two staples, by which the machine is drawn: under them, at *H*, are two hooks, placed low to raise the machine in turning, by the help of the traces; and the axle-tree of the cart should be fixed upon a pin, that it may turn like a waggon. *f f* are the triggers to throw the rake behind the roots. The long teeth at *g g* are to cleanse the roller *c*. *i i* is the rake which gathers up the weeds into the cart *h*, and is drawn above the trigger *f*, by the working of the arms *d*, expressed by the dotted lines at *d d*, *i i i*. The triggers *f*, of which there is one on each side, move on the pivots *a*; so that when the points *b*, of the rake *i*, having been drawn up by the directors *e* to the part marked *c*, the trigger, giving way, permits the rake to pass; but immediately falling, the rake returns along the upper surface of the trigger marked *e e*, and of course falls on the weeds when it comes to the end, a little beyond the pivot *a*.

It must be observed, that the boarding is taken away on one side, in the plate, in order to give a more perfect view of the inner parts of the machine; and, in fact, it would perhaps be better, if all the boarding, marked *l l l*, was taken away, and frame-work put in its stead. The cart *h* might also be made much lighter. The wheels *m m* appear in the plate to be made of solid wood; but there is no necessity that they should be so.

At *fig.* 5. is another view of the roller *c*, by which the disposition of the spikes may be easily comprehended. Suppose the circle *o*, described by the end of the roller *n*, to be divided by four straight lines into eight equal segments, as represented at *p*, *fig.* 6. Let the same be done at the other end of the roller, and parallel lines be drawn from one corresponding point to the other, the length of the roller: mark the points with figures, 1, 2, 3, 4, 5, 6, 7, 8; afterwards draw oblique lines, as from 1, at the end *o*, to 2, at the other end, and from 2 to 3, &c.: on these oblique lines the spikes are to be fixed, at equal distances, in eight circles, described on the circumference of the roller. The spikes of the small roller *b* are fixed in the same manner, except that, the diameter being smaller, there are only six instead of eight rows. At *r*, *fig.* 7, is another view of the directors, with the plank *e*, on which they are fixed; and *s*, *fig.* 8, is a section of a part of the plank, with one of the directors as fixed, in which may be seen the heel *m*, from whence, to the point of the share *n*, is a sharp-cutting edge. See the same letters in *fig.* 7.

At *t*, *fig.* 9. is one of the long teeth to be seen at *g*; it is bent towards the roller *c*, which it serves to cleanse. When the end of the rake *b*, after rising above *e*, is pushed, by the motion of the arms *d d*, along the upper part *e e*, of the trigger *f*, and comes to the end beyond *a*; as it falls, the part of the arm, marked *o*, rests in the notch *p*, till it is again raised by the motion of the roller *c*, with the rake. The roller *c* is to be one foot diameter, the spikes nine inches long, that they may go through the furrow (if the soil should be loose) into the hard earth, the more effectually to work the rake, which otherwise might be so overcharged as to cause the roller to drag without turning. In the rake-ends *b* there should be pivots, with rollers or pulleys on, to go in the groove, to take off the friction; and by this means they would likewise take the triggers more surely as the rake comes back. The rake should also be hung so far backwards, that when it is fallen the arms of it may lie in the same plane, or parallel with the directors, on which it comes up, which will require the frame to be two inches longer than represented. This will cause the rake to fall heavier, and force the teeth more into the ground, and bring up the weeds more certainly. The teeth must be made of steel, very fine, and so long as to reach down to the plank on which the directors are fixed, that is to say, six inches long; the directors are also to be made six inches broad above the plank. The rake-head should also fall a little before the crank is at its extremity, which will cause the rake to push forward to let the teeth come into the roots. The rake-teeth must drop in the same plane with the roller and wheels, or on the surface of the earth. No more space should be given from the roller *c* to the long teeth at *g g*, than that the rake may just miss the spikes of the roller *c*, and fall on the places before mentioned. As the first roller *b* was intended to cleanse the second *c*, more than any other use, it may be omitted when the machine is made large, as Mr. Ogden has found that the long teeth at *g g* answer the end alone, and this renders the machine about a sixth part shorter.

In order to suit any sort of earth, there should be to each machine three planks, with directors at different spaces, to use occasionally: in the first, the spaces between the directors should be eight inches wide, in the second six, and in the third four. This will answer the same end as having so many

different machines. The inventor would have the first machine made four feet six inches wide, the teeth divided into equal spaces, and the outsides into half spaces.

FALSE-QUARTER, in *farriery*, is a cleft or chink in the side or quarter of the hoof in the foot of a horse, running in a slanting direction with the horny fibres of the hoof, from the coronet to its basis, by which the horny substance of the crust is divided: one part of the hoof being in a manner detached from the other, and rendered unable to sustain its portion or share of the weight of the limb, &c. and hence the name of *false-quarter*: for, when the horse sets his foot on the ground, the chink widens; but, when it is lifted up, the hardened edges of the divided hoof take in between them the tender and soft parts, and squeeze them so as to occasion frequent bleeding at the chink. This is frequently attended with inflammation, a discharge of matter, and of course lameness.

This complaint, notwithstanding the different accounts commonly given as to the cause of it, is in fact the effect of a deep wound or bruise upon the coronet, by which the continuity of the parts has been entirely broken off; for we always find, that when the horny fibres are divided at their roots, they never unite or grow up as before, but leave a blemish, more or less, in proportion to the size and deepness of such wounds, &c. We have many instances of this, even in the human body; for when a wound happens at the root of the nail, whether in the fingers or toes, it occasions a blemish, which continues to grow in the same manner afterwards. Hence it will be evident, that no radical cure can possibly take place; but we may so far palliate the complaint as to render the horse something useful, by using a shoe of such a construction as will support the weight of the limb, &c. without resting or pressing too much upon the weakened quarter: for which purpose, a round, or what is called a *barred* shoe, will be most proper. The surface of the hoof on and near the diseased part may be cut down lower than the surface of the crust upon which the shoe is to rest; or, if the hoof will not admit of being cut down, the shoe may be raised up from the weak quarter. Either of these means will remove the weight of the body from the diseased part, and the horse will of course be relieved.

But as sand or gravel is easily admitted into the chink or crack, where, being accumulated and pent up, it irritates and inflames the parts, whereby matter is formed underneath the hoof, which causes lameness, and which not unfrequently breaks out at the coronet, producing the most inveterate ulcers, which become extremely difficult to heal, on account of the sinus or fistula branching out in different directions underneath the hoof: therefore horses with this defect should be carefully observed; and, when the thick hardened edges of the chink or crack grow too high, by which it is so much the deeper, and, of course, lodges the greater quantity of sand, &c. these edges should be rasped, or pared with a crooked knife, till the seam disappears. But wherever there remains a blackness, or appearance of gravel, that part must be traced farther; always observing, if possible, to avoid drawing blood. The chink or crack thus made smooth and equal, no sand or gravel can lodge in it; and as the parts will be tender, it will be necessary to apply an emollient poultice for some days, till the tenderness wears off. If the inflammation has been great, and matter formed in the crack, or the parts wounded by the knife in cutting its hardened edges, granulations of flesh may rise and jet out; but these may be restrained by dry lint and pressure, without the use of escharotics, which are absurd as well as cruel applications where the flesh produced is of a natural and healthy kind.

FAN-*Machine*, an instrument contrived for the purpose of winnowing corn.

It is remarked by Mr. Donaldson, in his Modern Agriculture, that wind is essentially necessary in cleaning grain, or seeds of any kind. The husks or chaff being lighter than the seeds which they inclosed, are by the force of wind carried to a greater distance, and thereby a complete separation takes place. The natural action of the winds being so extremely inconstant, no doubt, he thinks, induced the ancients to construct instruments by which the operation of cleaning grain was rendered less difficult and precarious. What these instruments were, except the shovel for throwing grain from one part of the barn or thrashing-floor to another, is now uncertain; probably, however, the sail-fan, so commonly used in this country, was among the number. It was not, he says, till little more than thirty years ago, that any other means was thought of in Scotland for separating grain from the chaff, than the action of the natural wind operating between the two doors of the barn. There a person stood for the purpose of dropping the grain from a kind of sieve, and in quantities proportioned to the force of the wind at the time. About the period above mentioned, the fan or fanner was introduced from Holland, where that kind of machine had been for a considerable time in common use, having been first brought to Holland from the East Indies, where they had been long used in cleaning rice.

The fan, which is the acting part of the machine, is capable of being turned round on its axis, with a greater or less degree of velocity according to the force of wind necessary to answer the intended purpose. One man works the machine easily by means of a handle; another is employed in filling the hopper, and a third in riddling and laying aside the grain, if not measured up at the time; when that is the case, more hands are necessary. Since thrashing-mills have been introduced, the fanners are generally wrought by them, in place of being set in motion by manual labour: by which means the unthrashed grain, after entering between the feeders of the thrashing-mill, becomes invisible, till it again appears in three divisions, each entirely separate from the other; the grain being forced to one place, the chaff to another, and the straw to a third—a degree of perfection in regard to barn-management

unknown in any other age or country. A machine of this sort is seen at *fig.* 1, in *pl.* XXXIV. It is sometimes termed a *fanner*.

FANTOME-*Corn*, a term applied to thin or light corn, which has but little bulk or solidity.

FAR, in *horsemanship*, a term used to denote a horse's right side, thus the *far* foot, *far* shoulder, &c. is the right foot, right shoulder, &c.

FARCY, in *farriery*, a disease of the skin and its blood-vessels, by which, when inveterate, the coats and integuments inflame and are so thickened, that they become like so many cords. At first, one or more small round buds, like grapes or berries, spring out over the veins, and are often exquisitely painful to the touch; in the beginning they are hard, but soon turn into soft blisters, which, when broken, discharge a glairy or bloody ichor, and turn into very foul and ill-disposed ulcers. In some horses it appears on the head only; in some on the external jugular; in others on the plate-vein, and runs downwards on the inside of the fore-arm towards the knee, and very often upwards towards the brisket.

In some, the farcy shows itself on the hind-parts, about the pasterns, and along the large veins on the inside of the thigh, rising upwards into the groin, and towards the sheath; and sometimes it makes its appearance on the flanks, and spreads by degrees towards the lower belly, where it often becomes very troublesome.

When the farcy appears on the head only, it is not so difficult of cure, especially when it is seated on the cheeks and forehead; but it is more difficult when it affects the lips, the nostrils, the eyes, the glands under the jaws, and other soft and loose parts, especially if the absorbents about the neck become corded. When it begins on the outside of the shoulder, or hips, the cure is seldom difficult; but when the farcy arises on the plate-vein, and that vein swells much, and cords are to be felt there, and the glands under the arm-pit are affected, it is hard to cure; but still more so when the crural veins withinside of the thigh are corded, and beset with buds, which affects the kernels of the groin and the cavernous body of the penis. When the farcy begins on the pasterns or lower limbs, it often becomes very uncertain, unless a timely stop is put to it; for the swelling in those depending parts grows so excessively large in some, and the limbs are so much disfigured with foul sores, that such a horse is seldom fit for any thing afterwards but the meanest drudgery; but it is always a promising sign, wherever the farcy happens to be situated, if it spreads no further. It usually affects only one side at a time; but when it passes over to the other, it shows great malignancy: when it arises on the spines, it is then for the most part dangerous; and is always more so to horses that are fat and full of blood, than to those that are in a more moderate case. When the farcy is epidemical, as sometimes happens, it rises on several parts of the body at once, forms nasty foul ulcers, and makes a profuse running of greenish bloody matter from both nostrils, and soon destroys the animal.

When the farcy makes its first appearance on the head, it rises on the cheeks and temples, and looks like a net-work, or small creeping twigs, full of berries. Sometimes it inflames the eye, and sometimes little blisters or buds run along the side of the nose. It arises often on the outside of the shoulder, running along the small veins with heat and inflammation; and sometimes a few small buds appear near the withers, and on the outside of the hip. In all these appearances, the disease being superficial, is easily conquered by the following method, when taken in time; for the simplest farcy, if neglected, may degenerate into the worst sort.

In this disease, when the horse happens to be fat and full of blood, he should be bled. This always checks the inflammatory stage of a farcy, but is of small service afterwards; and if a horse is low in flesh, it proves injurious. After bleeding, let the horse have four ounces of cream of tartar and lenitive electuary, which may be given every other day for a week; and then give nitre two ounces a-day for three weeks or a month, and anoint the buds or swellings with the following ointment twice a-day:

Take of hog's lard, four ounces; oil of turpentine, two ounces; sugar of lead, half an ounce; white vitriol, powdered, two drams; mix them together in a gallipot.

The buds sometimes by this method are dispersed, leaving only little bald spots which the hair soon covers again. When they break and run, if the matter be thick and well digested, they will soon be well: but in order to confirm the cure, and to disperse some little lumps which often remain for some time on the skin without hair, give the liver of antimony for a month; two ounces a-day for a fortnight; and then one ounce a-day for the other fortnight: by following this method, a farcy which affects the horse but slightly may be stopped in a week or ten days, and soon after totally eradicated.

When the farcy affects certain parts which we have described, the cure is more difficult; but let it always be attempted early; therefore, on the absorbents near the plate, thigh, or neck-veins appearing corded, bleed immediately on the opposite side, and apply the following to the part:

Take of oil of turpentine in a pint-bottle, six ounces; oil of vitriol, three ounces; drop the oil of vitriol into the oil of turpentine, by little at a time, otherwise the bottle will burst; when it has done smoking, drop in more oil of vitriol, and so on till all is mixed.

This mixture is one of the best applications in a beginning farcy that can be used; but where it is seated in loose fleshy parts, as the flanks or belly, equal parts of the oil of vitriol and turpentine are necessary. Rub the parts first with a woollen cloth, and then apply some of the mixture over the buds, and wherever there is any swelling, twice a-day. Give the cooling physic every other day, and two

or three ounces of nitre every day, for some time.

When the farcy begins on the flanks, or towards the lower belly, it often takes its rise from a single puncture of a sharp spur. The pain and smarting are one sure sign to distinguish the farcy from common accidents; the staring of the hair, which stands up like a tuft all round the buds or blisters, and the matter that issues from the buds, which is always purulent, and of a clammy greasy consistence, are other certain signs. After bathing with the liniment above mentioned till the ulcers are smooth and healing, should the swelling not subside, to prevent the spreading of the buds, and to disperse them, bathe with either of these mixtures as far as the centre of the belly; and at the same time give such a course of antimonials as will presently be prescribed.

In the lower limbs, the farcy lies sometimes concealed for a great while, and makes so slow a progress, that it is often mistaken for grease, or for a blow or kick, and goes by the general appellation of a humour settled there. In order to distinguish the one from the other, we shall observe, that a kick or bruise is generally attended with a sudden swelling, or a contused wound, which for the most part digests easily: the grease is also a smooth swelling that breaks out above the bending of the pasterns backwards; but the farcy begins on the pastern-joint usually with one bud, and runs upwards like a knotty crab-tree.

Very simple means have sometimes stopped it, before it has begun to spread; a poultice with bran and verjuice bound round the part, and renewed once a day, will often alone succeed; and if excrescences arise, touch them with oil of vitriol, or aquafortis, an hour before you apply the poultice; for when the distemper is local, as we suppose it here, it is to be conquered by outward applications.

The following balls are proper in every state of the farcy; and when the distemper has been in its infancy, before the skin was much defaced, have often cured it in a week or two, by giving them only once or twice a-day: but in an old farcy they should be given for two or three months together.

> Take of cinnabar of antimony, eight ounces; long birthwort and gum-guaiacum, powdered, of each four ounces; make into a paste with honey, and form into balls of the size of a large walnut, and roll them in liquorice-powder.

The tediousness of this course has encouraged the giving of mercurials, and introducing them into the blood, without operating on the stomach and bowels. To do this effectually, Mr. Bartlet observes, they must be given in small quantities; and taken in this manner, they will mix gradually with the blood and juices, and operate both effectually and safely.

The knots and cords should be rubbed with mercurial ointment, in order to disperse them. If they break, it will be right to dress the sores with equal parts of Venice turpentine and quicksilver; if by these means the mouth should become sore, treat as above. This method seems to be promising, if proper care be taken.

The following is also recommended by the same writer:

> Take of butter of antimony and bezoar mineral, of each one ounce; beat up with half a pound of cordial ball; and give the bigness of a walnut, or three-quarters of an ounce, every day for two or three weeks, fasting two or three hours after it.

The following mode of treatment, and forms of medicine, are prescribed by Mr. Taplin: Upon the very earliest appearance of the disorder, blood is to be taken away in sufficient quantity. If the horse is in high condition and full of flesh, give him mashes through the day of bleeding, and the next day; and on the following morning a purging ball, composed of socotorine aloes, ten drams; calomel and jalap, in powder, each two drams and a half; rhubarb and ginger, of each a dram and a half; with syrup of buckthorn, or roses, sufficient to form the ball. Let the purge be carefully attended to, and duly worked off. If the physic works favourably, and sits well, let his feed (if his appetite is keen) for four days be plentiful, and on the fifth or sixth at farthest repeat his purging ball. If the attack has been violent, or the disorder makes rapid progress, a third dose must be given in like manner. In two days after the course is completed, it is directed to begin upon the following antimonial alteratives, assisted by a regular administration of nitre; both to be continued a month without any intermission:

> Take of prepared antimony, one pound; common sulphur, twelve ounces; cream of tartar, eight ounces; and cinnabar of antimony, six ounces:

which being incorporated well in a mortar, is to be divided into twenty equal parts. Of these, one is to be given every night in the corn, first sprinkling with water to insure its adhesion, and two ounces of nitre are to be mixed with the water every morning, at which time he will generally drink it with the greater avidity, as being most thirsty. The buds or swellings upon their first appearance may be well washed with the following, twice every day, viz. with a lotion composed of extract of saturn, two ounces; camphorated spirit of wine, eight ounces; and distilled vinegar, a pint; mixed well together, and kept close stopped for use.

In a more advanced or inveterate stage of the distemper, moderate bleeding should be repeated at proper intervals between the physic; and the scabs or eschars peeling from the buds, washed well occasionally with the following:

> Take of corrosive sublimate, two drams; dissolve it in half a pint of British brandy, add a pint of white-wine vinegar, half a pint of spring water, and two ounces of tincture of myrrh; shaking them well together. Or,

> Take of sugar of lead and white vitriol, each an ounce; distilled vinegar and spring-water, each one pint; styptic tincture, three ounces; mix them well together.

If the ulcers should continue foul, and their edges become callous, very small quantities of the strong

mercurial ointment must be gently rubbed into the centre of the most inveterate, once in three or four days, cleansing them occasionally with one of the washes before mentioned. In this case, one of the following balls must be given regularly every morning for a month, or longer, if necessary. The proportion of nitre must be altered to three ounces, and given in the water every evening, the ball being administered in the morning:

Take of æthiops mineral, four ounces; flowers of brimstone, prepared antimony, cream of tartar, and cinnabar of antimony, each five ounces; honey, sufficient to make a mass; which divide into a dozen equal balls, and roll up in liquorice or anise-seed powder.

It may not be improper now to add the symptoms of an incurable farcy, that the owners of such horses may save themselves unnecessary expense and trouble in their endeavours to obtain a cure. When a farcy, by improper applications, or by neglect, has spread and increased, or after long continuance resisted the medicines above recommended; if fresh buds are continually sprouting forth, while the old ones remain foul and ill-conditioned; if they rise on the spines of the back and loins; if the horse grows hide-bound, and runs at the nose; if abscesses are formed in the fleshy parts between the interstices of the large muscles; if his eyes look dead and lifeless; if he forsakes his food, and scours often, and his excrements appear thin and of a blackish colour; if the plate or thigh vein continue large and corded after frictions and other proper applications; these symptoms denote the distemper to have penetrated internally, and that it will degenerate into an incurable consumption: it is most probable also that the whole mass of fluids is tainted, and become irremediable by art.

Before concluding the account of this disease, it may be proper to take notice of what is called *water-farcy*; which has no resemblance to a true farcy, either in its cause, symptoms, or effects, but has only obtained this name through custom and ignorance.—The water-farcy, then, is nothing more than an œdema of the skin, which often happens in epidemical colds. In some cases it appears more generally dropsical, and the water is not confined to the belly and limbs, but shows itself in several parts of the body by soft swellings yielding to the pressure of the finger. This last kind usually proceeds from foul feeding, or from the effects of the latter grass. In the former case, we see the limbs and whole body swell enormously, and become very hard, the belly and sheath greatly distended; yet these may be reduced by slight scarifications within-side the leg and thigh with a sharp pen-knife, and three or four strokes on the skin of the belly on each side of the sheath. A few purges afterwards will generally complete his recovery. In both cases the curative intention s are to discharge the water, and brace up the relaxed solids throughout the whole body. To this end purge once a-week or ten days; and give imme diately either of the following:

Take of black hellebore, fresh gathered, two pounds; wash, bruise, and boil it in six quarts of water to four; and then strain out the liquor, and put two quarts of white-wine on the remaining hellebore, and let it infuse warm forty-eight hours: then strain off, mix both together, and give the horse a pint, night and morning.

Take of nitre, two ounces; squills powdered, three drams or half an ounce; camphor, one dram; honey enough to form into a ball, to be given once a day alone, or washed down with a horn or two of the above drink.

Water-FARCY, the name of a disease in horses, which differs very materially from the farcy, as has been seen above. It is sometimes denominated *farcien*. See *Water-Farcy*.

FARDING-*Bag*, the first stomach of a cow, or any other ruminant animal.

FARE *of Pigs*, a provincial mode of expressing the number of pigs which a sow brings forth at once. See *Farrow*.

FARM, a portion of ground cultivated by the owner or tenant in different ways, according to circumstances, for the purpose of obtaining profit from it. There are different sorts of farms, from the different methods in which they are cultivated or employed. Where the principal part of the land is under the plough, they are termed Arable-farms; but where the fattening of cattle or other sorts of live-stock is more immediately the object, they are distinguished by the title of Grazing-farms; where the chief intention is the obtaining different sorts of animal products, such as milk, butter, and cheese, they are denominated Dairy-farms; and where the two systems of arable and grass management can be combined, they are called Convertible-farms. As manure must be had in order to render farms of any kind productive, the last sort may probably, in general, be considered as the most advantageous. Besides these, in districts where hay is the principal produce, there are hay or grass-farms, and there are also what are denominated breeding or cattle-farms.

The ancient writers on husbandry, who lived in warm countries, where the heat and moisture of the air had sensible and frequently very dangerous effects on the health of the inhabitants, were very particular in their directions for the choice of farms or estates, and of the spots whereon houses should be built, so as to avoid the inconveniences arising from the climate, or from the quality or situation of the ground. But though the temperate air which we enjoy in this island renders such directions less necessary; yet as several places in it are remarkably sickly, and as, even in the most healthy situations, many houses and villages are built upon the least healthy spots, it must be of considerable advantage to those who can make their choice, to know what soils and places ought to be avoided; and of such as are already fixed, to be acquainted with the means of correcting those inconveniences which cannot be totally remedied. The Romans had generally pleasure as well as profit in view, when they bought or

stocked a farm; and therefore they laid it down as a rule, that no degree of fertility should tempt a man to purchase in an unhealthy country, nor the pleasantest situations in a barren one. "Buy not too hastily," said the wise Cato, "but view again and again the purchase you intend to make; for, if it be a good one, the oftener you see it, the better it will please you. Examine how the neighbouring inhabitants fare. Let the country it lies in be a good one; the ways to and from it good; and the air temperate. Let your land, if you can choose your situation, be at the foot of a hill, facing the south, in a healthy place, where a sufficiency of labourers, of cattle, and of water, may be had. Let it be near a flourishing town, the sea, or a navigable river; or bordering upon a good and well-frequented road. Let the buildings upon your ground be strong and substantial. Do not rashly condemn the methods of others. It is best to purchase from a good husbandman, and a good improver.

Besides the healthfulness of the situation, three other things should be particularly attended to in the choice of a farm or estate; these are the air, the water, and the soil. The air should be pure and temperate, the water wholesome and easily come at, and the soil rich and fertile. The knowledge of the healthiness of the air is, as Lord Bacon observes, discoverable rather by experiment than by reason or conjecture. To examine the moisture of the air before a house is built, wool, or a sponge, may be hung up in the place, and afterwards compared with some of the same, exposed in the same manner, and at the same time, in another place. According as they gain more or less in weight, the air is more or less humid. The air is liable to greater alterations, from heat and cold, in some places than in others; and as that inequality in the air is an enemy to health, the most equal should be chosen. This is easily determined by the thermometer, and by viewing the situation of the place; for the intermixture of hills and valleys, though pleasing to the eye, may be held suspected as to the lengthening of life, because of the variations of heat and cold.

The ancients were particularly attentive to the quality of their water, and to the ease of coming at it. They advised bringing into the farm-houses the water of such springs as never dried up; or, if there was no such spring within the farm, to bring running water as near to it as may be; or to dig for well-water, not of a bitter or brackish taste. If neither of these was to be found, they directed large cisterns to be provided for men, and ponds for collecting and retaining rain-water for cattle. They esteemed that running water to be best for drinking which had its source in a hill; spring or well-water from a rising ground was deemed the next best; well-water in the bottom of a valley was held to be suspicious; and marshy or fenny water, which creeps slowly on, was by them rightly looked upon as the worst of all. That water is known to be wholesome, which has no mineral in it, is perfectly clear, has not taste or smell, deposits no slimy sediment, leaves no spots or incrustation when boiled in copper or brass vessels, and which boils pulse in a very little time. As springs and well-water pass through beds of sand, gravel, or small stones, these clear it of all impurities, unless there be mixed with them substances which are soluble in water. If any mineral is mixed with the water, it is unfit for the farmer's use. If it be hard, it is thereby rendered unfit for washing, and some other culinary uses. This is the kind of water which gives flesh boiled in it a red colour. But even the hardest water may be easily rendered perfectly soft, and fit for any use, by mixing with it a small portion of pot-ash, or fixed alkali, or, for want of these, the ashes of any burnt fresh vegetables.

In respect to the goodness of the soil, it should be judged of from a minute examination and comparison of different circumstances, such as the appearances of the trees, hedges, crops, and different plants, that are produced upon it, as well as from its particular nature and colours.

There are many different circumstances to be considered with attention in engaging farms, of whatever kind they may be:—It is observed by Mr. Donaldson, in his View of the Present State of Husbandry in Great-Britain, that when a farmer has occasion to hire a farm, he should be equally careful to examine, on the one hand, all the advantages which it enjoys, and, on the other, all the disadvantages to which it is subjected. By making a just estimate of both, and by comparing the result with the rent demanded, can he only be able to form a correct opinion respecting the equity of that demand. In making this estimate, he should discard equally from his mind, that over cautious prudence, which is disposed to doubt of every probable advantage that may insure success, and that too adventurous temerity, which is apt to overlook, or at least to lessen, real disadvantages, such as no future exertion of his can possibly overcome. The value of land, says he, depends no less on its fertility, whether occupied in tillage or pasture, than on its situation in regard to markets. For this reason, an arable farm in the vicinity of a large town is worth a higher rent than one of an equal size and quality in a remote part of the country. For the same reason, namely, a superior advantage in regard to markets, a sheep or store-farm in the north of England yields a higher rent to the proprietor than one (but for the difference of situation) of similar value in the north-west of Scotland. In renting a farm, one general rule ought, he thinks, always to be attended to, namely, fixing on good lands. Over the kingdom at large, the rents paid for farms of this description are in general reasonable, when compared with what is commonly paid for those of more indifferent soils. The author of the New Farmer's Calendar, however, well remarks, that it can obviously very seldom happen, that a tenant, in want of a farm, can have the opportunity of choosing precisely that kind of soil and situation which may be deemed the most advantageous; in general, he must content himself with such as chance to be unoccupied; and these chances, in fruitful parts of the country, have never been of

late years, and since the vast enhancement in price of all the fruits of the earth, very numerous. But the superior advantages of natural fertility and facility of cultivation are too plain to admit of question or argument: and nothing is more clear, than the preference which ought to be given to good land at the advanced price, since the culture of barren land is infinitely most expensive, and the risk of crop nearly double: and what is of great force, from the influence of custom and local circumstances, the price of land in the most fruitful countries is frequently as low as of that in districts of far inferior fertility. An attentive observer, although not very conversant in the principles or practice of husbandry, can scarcely, he thinks, be deceived as to the general nature and degree of goodness of soil upon a farm; a comparison with the neighbouring farms, and their average products, will be a sufficient guide. Wherever, says he, is found considerable depth of mixed soil, even if natural fertility be deficient, art and culture will remedy the defect, and fully reward the labours of the husbandman: on the other hand, the most shallow and stony lands, from a natural richness in their light moulds, may be wonderfully productive. The luxuriance and deep verdure of the grass, the spontaneous growth of white clover, the tallness and fruitfulness of the hedge-wood, particularly hazel, the large size of the timber, and the height and substance of the straw, are all common indications of a strong and fertile soil: plenty of weeds, particularly thistles, although a popular, he fears is but an equivocal, sign, since the most barren land will also produce spontaneously abundant crops of those. It is much more prudent for a farmer, he thinks, to wait, and look forward, than to engage himself upon a miserable barren tract, where the certainty or promise can be of nothing but everlasting labour and expense: such must be the case upon soils which are naturally poor, at the same time of insufficient depth, and abounding with flint or shingle; upon sandy wastes, parched gravels, cold, acid, iron clays, boggy or poachy lands, to or from which there is scarcely access or passage during the winter-months. Some such tracts we have in England; and of those held in hand an opulent and well-skilled proprietor can make a far greater annual profit than can be drawn from the labour of a needy and miserable tenant. The most profitable purposes to which these estates can be devoted are, he conceives, the growth of wood and of live-stock. A farmer who aims at obtaining his profits with the least possible trouble and risk, and without the burden of much live-stock, must procure a rich light land-farm, with a sandy loam; on such a situation, with a moderate capital, and the example of his neighbours before his eyes, he may, he thinks, set himself down in contented indolence, and yet grow rich. The case is widely different with him who engages with a strong clay, or in the improvement of an exhausted or inferior soil; this will find an ample field for the most strenuous exertions, directed by a fair portion of agricultural skill, and ought to entertain no hope of very considerable success, without the aid of a full stock of cattle. These observations are, he says, by no means intended to damp the ardour of aspiring husbandmen, who aim at raising a fortune and a name by the improvements of low-priced land: for although, from the irregularity of rate per acre above hinted, the rent of land is seldom the prime cause of good or ill success, yet cheapness is a material consideration, when money is to be expended in gradual improvement. A farm at four or five shillings per acre, possessing within itself, or its vicinity, the permanent means of amelioration, will turn out a mine of wealth in the hands of an able cultivator, who, in the course of half his lease, will bring it to a level of fertility with the high-prized kinds of land.

There is, Mr. Donaldson remarks, another point which merits attention,—the manner in which the farm was formerly cultivated. If it has been exhausted and run out by over cropping, and requires fencing, draining, repairs of houses, lime, marl, &c. all which are to be effected at the tenant's expense, the rent payable to the landlord in such a case ought, he justly observes, to be very moderate, in comparison to what the tenant could with equal propriety afford to give, were he to enter on the lease when the farm was in a high state of cultivation and improvement. The difference here is, he says, much more considerable than the generality of proprietors or farmers are disposed to allow. For instance, a farmer who enters to the possession of a farm in a high state of cultivation, enters immediately to the greatest returns which that farm is capable of producing; while he who enters to a farm which had been previously exhausted by improper management, finds himself under the necessity of expending large sums on the improvement of it; when, at the same time, his returns for the first few years are probably inadequate to the expense incurred in carrying on even the ordinary operations. In the one case, the farmer enters, from the beginning of his lease, on the receipt of his annual profits, moderate as they may be; and in the other, he is sinking a large share of his capital, from which his returns must at best be slow. If this loss of capital and interest, the additional expense of cultivation, and the inferiority of crops for the first seven or eight years, are fairly calculated, it will, he thinks, be found, that the farmer who, under these circumstances, pays twenty shillings the acre for a lease of nineteen years, has as high a rent upon the farm, during the whole lease, as the other who pays nearly double the sum.

One other particular of great importance ought, he says, to be mentioned, namely, the impropriety of renting a larger farm than the capital which the farmer possesses will properly stock and improve. When this happens, the tenant puts it out of his power to adopt the proper plans by which he could turn the farm to the greatest possible account. He becomes cramped in carrying on the ordinary course of business, and is frequently obliged to dispose of his crops at an under value for ready money; and therefore cannot purchase lime, marl, or other means

of improvement, which are not to be had without the expenditure of considerable sums. Although it will not hold in every case, yet it may be asserted as a good general rule, that, in the improved parts of the kingdom, four pounds *per* statute acre is a moderate sum for stocking a farm, without including the expense of buildings, repairs, fences, drains, &c. If, therefore, a farmer should be so imprudent as to rent a farm of one hundred acres, when his capital does not exceed 200*l.* he must be fortunate indeed in times and seasons if he has not occasion to repent of his temerity.

And by the author of the Farmer's Calendar it is observed, that it is doubtless a sound general maxim, for a man to hire no more land than his capital is amply sufficient to stock; the disadvantages and dangers of a want of money, in all concerns, are too common and well known to be for a moment insisted on; the farmer had indeed better be somewhat short, than burdened with too large a tract of land: for, in the latter case, if he be judicious, and master of his profession, he may well employ his surplus capital in a superior and garden-style of cultivation, and as a dealer in live-stock. But it is yet a grating thing to an industrious man, to refuse a promising bargain, particularly of the low-rented kind, on account of its extent, the very consideration which must animate his hopes; and when such a one has made the leap, instead of the common method of aiming at the culture of the whole in a slovenly, insufficient, and unprofitable manner, it would probably be much the safest plan, to crop only such a portion of the farm as his means would compass with good effect, seeking but to pay the rent and live, and, by dint of frugal and persevering industry, to make an annual addition, until, in process of time, the whole farm should be in a flourishing state of cultivation. He cannot forbear, he says, in this place, copying an important remark from Mr. Young, which, in truth, he has repeatedly seen verified. Farmers frequently adopt no other rule respecting the rent they will give, than mere custom, nor attend to any other criterion of estimating the worth and qualities of land, than that of the good or ill success of the last occupant; than which there can scarce be a more fallacious method of forming a judgment. He has known many farms, on which fortunes might have been obviously, and afterwards were really, made, lie untenanted, and taken afterwards with the utmost apprehension, purely because an ignorant, wretched, and needy tenant had failed therein. Many fine farms may now be pointed out, on which the old tenants starved, and brought their families to the work-house, at seven shillings an acre; whilst their successors (times still the same, or worse) made their fortunes, by being rented at eighteen. It is a cruel disgrace, or rather a very laughable piece of burlesque, for a man pretending to common discernment to regulate his judgment and his conduct from motives like those. If fair land be offered at a fair rent, it is well; if an additional rent be demanded, and a man, after the nicest scrutiny, both actual and probable, can discover money's-worth in the terms, he must be unwise to forego the occasion. Some landlords, from a magnanimous and princely spirit, have supposed it beneath their dignity to raise their rents; and certain tenants, mistaking the nature of this bounty and the question in general, are extremely averse to the very idea of any advance, not considering that it is a question of property, and that landlords as well as tenants have all possible right and reason to make a fair advantage of the growing prosperity of the times. Those men who are averse to a distant removal, by which they might obtain a far superior situation, from the single consideration of present loss in the disposal of their stock, do not, the author thinks, well understand their own interest. A present trifling loss, which the farmer's circumstances can well bear, ought not to weigh against a permanent and growing profit: this motive, however, confines many a farmer to a poor and barren spot: men are absolutely afraid of fair calculation, as they often are of their best friends.

In the examination of a bargain, he observes, the objection may be of a twofold nature: such as may be held insuperable; or such as may admit of compensation, either in proportional abatement of price, or in the goodness of the prospect. As to the first, on perceiving them, a man instantly turns his back on the business. In his own ideas, tithes taken in kind; a number of common carriage-ways, or paths, and the lands intersected by other property; far-distant markets, and roads impassable in winter, are objections of that class; and granting pecuniary compensations can be made, there can be none found adequate to the anxiety of mind which must be inevitably suffered in such a situation. Of those defects, with which a person is content to put up, he ought to have a very correct estimate, that he may really know when an offer is made deserving of his acceptance; an important point, where many contracting parties fail. Every practical man knows, that, in bargaining, as in angling, there is a critical moment, a time to strike, which may never return. The heads already enumerated will, he says, furnish matter for an estimate in writing, taken on the actual survey. Thence will appear the sums necessary to be expended, and the deduction of rent or other recompence such expenditure will fairly warrant. In this estimate, the state or nature of the fences should be well considered, and also the injuries done by game in some instances.

After fully attending to the above circumstances, Mr. Young advises the farmer, in hiring a farm that is offered him, to "examine the soil well, to be able to determine its nature, the stiffness, moisture, exposure, levelness, slope, stonyness; what draining, manuring, fencing, &c. may be wanted;" to see to the roads, distance of market, prices of commodities, labour, &c.; to fully acquaint himself with the state of tithes or gathering. "He should, he says, know the poor-rates, attend to the compactness of the fields, and consider well the covenants relative to cropping; for many such are extremely detrimental.

to a good conduct of the land." He recommends, that one general rule in hiring a farm should not, by any means, be forgotten—" to fix on good land, and he can scarcely pay too much for it; but, for poor soils, the least rent is sometimes too high to be consistent with profit. By poor soils, however, are not to be understood, he says, such as have a command of lasting manures, that work great improvements; nor waste lands, which, under that false denomination, are often found the most profitable of all." He thinks, that " the sound, mellow, rich, putrid, crumbling, sandy loams, are of all soils the most profitable; such as will admit tillage soon after rain, and do not bake on hot gleams of sun coming after heavy rains, when finely harrowed: such land is, he says, better worth forty shillings an acre than many soils deserve five" for the same extent.

He next takes notice of the " stiff loam, which is nearest allied to brick earth; this, till drained, is, he says, in general an unkindly soil, without plenty of manure. It is known in winter by being very adhesive upon walking over it; is long in drying, even when little or no water is seen upon it: for which reason it is generally late in the spring before it can be ploughed. When quite dry, it breaks up neither so hard and cloddy as mere clay, nor near so crumbly and mellow as the good loam. If it is in stubble, it is, he says, apt to be covered with a minute green moss. There are many varieties of this soil, but all agree in most of these circumstances, and in being what the farmers call poor, cold, hungry land. When hollow-ditched, and greatly manured, it yields, he says, any thing; but those who hire it should forget neither of these expenses" in the bargain.

In regard to gravelly soils, it is remarked, that they are numerous in their kind, and very different in their natures. " Warm, dry, sound gravelly loams, are easily distinguished, the writer says, in winter. They admit ploughing all winter through, except in very wet times; always break up in a crumbly state of running moulds; and if a stubble, will dig on trial by the spade, in the same manner. If under turnips, it may be perceived by walking through them, that it will bear their being fed off." But " the wet, cold, springy gravel, is, he thinks, a very bad soil; it is known in winter by the wetness of it; and in spring, by its binding with hasty showers. It rarely breaks up in a crumbly state, or shews a mellowness under the spade. Very expensive drains greatly correct its ill qualities, but it requires, he says, a prodigious quantity of manure to fertilize it." And other " gravels are so sharp and burning, that they produce nothing except in wet summers; but such are known, he observes, at any season of the year."

The sand-soils are as various as the gravels, and are all easily discoverable in their natures. " The rich, red sand, is, he believes, as profitable a soil as any in the world. It has at all seasons, he remarks, a dry soundness, and at the same time a moisture without wetness, which secures crops even in dry summers. The spade is sufficient to try it, at any season of the year." And the " light sandy loam is, likewise, he thinks, an admirable soil: it will bear ploughing, like the preceding, all winter long, and appears quite sound and mellow when tried with the spade. If it lies under a winter fallow, the best way to judge of its richness, is, he says, to remark the state of the furrows, and the degree of adhesion in the soil. Stiff land, being dry and crumbly, is a great perfection, and sand, being adhesive, is an equally good sign." It is therefore concluded, that when " the farmer views a light sandy loam, whose sound dryness is acknowledged, he may presume the soil is rich, in proportion to its adhesion," or the closeness with which its particles unite. Where " it falls flat in powder, and has no adhesion, it is a mere sand. The white chalky *marm* is, he says, often cold and wet, will not bear ploughing in winter, unless the weather is very dry or frosty; runs excessively to mortar with a heavy shower when in a pulverized state. It is a cold soil, of little profit, he supposes, except with peculiar management:" he supposes it to answer best laid down to sainfoin, when dry.

He advises the farmer in common to " lay it down as a maxim, that strong, harsh, tenacious clay, though it will yield great crops of wheat, is yet managed at so heavy an expense, that it is usually let for more than it is worth. Much money is not often made on such land. The very contrary soil, a light, poor, dry sand, is very often indeed in the occupation of men who have made fortunes. Some permanent manure is usually below the surface, which answers well to carry on: and sheep, the common stock of such soils, is the most profitable sort he can depend on," in cases of that kind.

He observes, that " all the stiff sorts of soils are viewed to most advantage in winter: the general fault of them is, he says, wetness, which is in the greatest excess at that season of the year. If the fields are level, and the water stands in the land, notwithstanding the furrows are well ploughed and open, it is a sign, he observes, that the clay is very stiff, and of so adhesive a nature as to contain the water like a dish. It is likewise probable, that draining may prove insufficient to cure the natural evil of such land. This kind of soil, likewise, shews itself, he says, in the breaking up of stubbles for a fallow; a very strong draught of cattle is then necessary to work it. It breaks up in vast pieces almost as hard as iron. When it is worked fine, it will run like mortar, with a heavy spring or summer shower. These soils will yield very great crops of beans and wheat, &c. They must, like others, be cultivated by somebody; but he would advise every friend of his to have nothing to do with them; never to be captivated with seeing large crops upon the land; for he does not see at the same time, he remarks, the expenses at which they are raised" in such land. He thinks, that " peat, bog, moor, and fen, in many variations, are very profitable; but the expenses of improvement demand, he says, a

calculating head. "The vicinity of lime or marl is here of great importance" in the decision that is to be made.

With regard to "grass-lands, the marks for judgment are, he says, different. These are, in his opinion, best examined by attending, first, to the circumstances in which they are most deficient: and then to such as are in their favour. The more seasons grass-fields are viewed in, the better; though any one is sufficient for a tolerable judgment" in such cases. It is added, that one great "evil attending these lands is, that of being too wet; the signs of which can never be mistaken or overlooked in any season of the year. In winter, it is at once perceived by walking on it; at all times of the year by the herbage which generally abounds on it, such as rushes, flags, and a great quantity of moss; and also by the colour of the grass, which is mostly blue at the points; sometimes of a dirty yellow hue, and always coarse. If the soil is the first described stiff clay, and the surface level, the evil will be very difficult of cure; if of the other sort of clay, or stiff loams, draining will have great effects" in removing its imperfections.

It is suggested, that "grass-fields on gravelly soils are, if the gravel is sharp, very apt to burn in dry summers; but they give great and sweet crops in wet ones, provided the land is a gravelly loam. An *absolute* gravel should never be under grass. A farmer should not, however, he thinks, regret having a pasture or two of this sort in his farm, as they are of excellent use in winter for feeding sheep and lambs on with turnips," or other similar sorts of food.

In respect to "the low meadows, whatever the soil may be on the banks of the rivers and brooks, they are in general good, but often subject to the misfortune of being overflown in summer, which not only ruins crops of hay before they are cut. but carries them away, perhaps, when just made," which is a great disadvantage. And he suggests, that "many grass-fields on all soils, consist of so bad an herbage as to be of little value. Made up of weeds, and the worst and coarsest of grasses, if a landlord will not allow such to be ploughed, the "farmer should, he says, minute the rent accordingly. This fault is visible at all seasons," and cannot be easily mistaken. And he concludes by remarking, that a river that does not overflow, running through a farm, is a very favourable circumstance, as it indicates a probability of all the grass-fields being well supplied with water for cattle and other animals.

The circumstances that have been already noticed in regard to proportioning the size of the farm to the extent of capital, should constantly be kept in view. There are several other circumstances to be regarded in fixing upon farms, such as their being compact, or lying convenient in the fields, which farmers too often overlook. "If they attended to it, as much as their profit required, we should, Mr. Young says, see landlords reforming their estates in this particular, more than many do at present. There is not, he thinks, a more expensive, perplexing circumstance in a farm, than the fields being in a straggling, disjointed situation. The disadvantages are numerous" and strikingly obvious to every one.

The circumstance of covenants should likewise be noticed, as landlords are very often "tenacious of the covenants which they have usually inserted in their leases; so that a man, when he approves a farm and agrees to the rent, may find the conditions of tenure proposed to him, such as are incompatible with his interest, his designs, and even with good husbandry." But the "merit or reasonableness of covenants must, he says, be considered always, on comparison with the nature of the farm. It is for want of this consideration, he thinks, that unreasonable covenants are ever proposed." And he adds, that "these prohibitions are often foolish, but sometimes admissible: they must depend on local circumstances, to be well weighed by the farmer," before he decides in respect to hiring the farm.

It is further stated, that the "ascertainment of rent is a very important part of the business of hiring a farm; but that the above circumstances precede it, as the rent in a good measure depends on them. The principal point here necessary to be considered, is the combination of rent, tithe, and rates, in one sum." He advises the farmer, "on knowing the capital intended to be invested, to estimate the interest of it at not less than 10 per cent. and then to calculate the expenses and produce; the former deducted from the latter, leaves that sum which the farmer can afford to pay in these three sorts of rent. And deducting in addition the tithes and rates, the remainder will be what he can afford to pay to the landlord. Where rent is calculated in any other way, it must, he says, be erroneous and deceitful, and cannot be depended upon."

On the whole, the author of Modern Agriculture concludes, that the farmer who intends to hire a farm ought to consider, whether the land be rich and fertile, and the climate favourable; likewise, whether the farm is well situated in regard to markets; properly accommodated as to houses; has easy access to lime, marl, and other manures; and, whether the price of provisions is fully on a par with the rate of labour.

Proper Size of Farms.—In regard to the size of farms, Mr. Donaldson remarks, that it is not proposed to decide as to the precise number of acres which constitute what is generally denominated a proper-sized farm. The person who attempts to do so will, he thinks, be involved in difficulties, from which he will find it impossible to extricate himself; while his hypothesis must be liable to so many objections, as to evince in the clearest manner, that, without considering the subject in various points of view, it is impossible to form even a general conclusion. This subject, which, though apparently simple, involves a great variety of particulars, may probably, he says, be best elucidated, by explaining, how far large and small farms are advantageous or otherwise to the proprietors, the occupiers, and the nation in general.

Large Farms.—If, says he, the introduction of improvements in cultivation, and the breeds of the different species of live-stock, are objects of importance to the proprietors of the kingdom as individuals, large farms must be considered by them as beneficial. As individuals, also, they must experience other advantages from large farms. The extent of capital employed in stocking and cultivating these farms, insures a regular and prompt payment of the rents. Building and repairing farm-houses on such farms, although considerable at first, is not so heavy an annual charge as on small farms; while the expense of inclosing and subdividing does not amount to one-tenth part. It was fortunate, he thinks, for British farmers, as well as for British husbandry, that proprietors adopted the resolution of letting part of their estates in large farms. By that means, men possessing every requisite for constituting them good farmers turned their attention to the cultivation of the soil, and the introduction of every improvement connected therewith; and, in very many instances, have not only been so successful as to maintain and educate their families in ease and comfort, but also to acquire such fortunes as to render them independent proprietors—a circumstance that must give sincere satisfaction to every liberal mind; as, from the service they have done in promoting the interests of agriculture, they are well entitled to enjoy the fruits of their industry. In regard to the community, large farms, he says, must be considered as favourable in several respects. On what farms, he asks, in Norfolk have turnips been cultivated, and used to the greatest advantage? On what farms in the Carse of Gowrie has the cultivation of grain been most successfully carried on? In Leicestershire, where have the greatest improvements in the different breeds of live-stock been effected? In the counties of Northumberland and Berwick, where have improved breeds of stock been most generally united with skilful culture? Every person who has travelled through these districts, with a view of procuring agricultural information, must, he thinks, answer, On large farms.

It is, he observes, from large farms also that the towns are principally supplied with the great articles of grain, fat cattle, and sheep, of the best quality. And as farms of this size are kept in the highest state of cultivation of which the lands are susceptible, and managed with the fewest number of hands, the greatest quantity of produce that can be spared from the like extent of land necessarily goes to market. To the occupiers of large farms it is also chiefly owing that the supply of the towns in these indispensable articles is so regularly kept up. If these farmers could not afford to keep their grain and fat stock on hand till those of the poorer tenants were disposed of and consumed, the markets would either be overstocked at particular seasons, and entirely empty in others; or, what is equally bad, the articles would get into the hands of a few dealers, who, by mutual consent, might raise the price to any extent they pleased, notwithstanding any acts of parliament against forestalling that could possibly be framed.

There is, he says, one particular description of farms, which ought to be taken notice of here; these are in some places called *led-farms*, in others *grass-farms*. Many farmers rent one or more large farms in different parts of the country, which are managed by an overseer. These are, he conceives, for the interest of the proprietor, because he generally receives a higher rent than could be afforded, were the farmer's family to be maintained from the profits of any of them alone: a great proportion being also allowed to remain in grass, the lands must be in an improving state. The farmer, after paying the extra rent, and the wages of an overseer, still retains that proportion of profits which renders the renting of such farms an object to him: but, when it is considered that the farmer's close attention to minute particulars in the management of a farm is absolutely necessary to make it to the highest degree profitable, it is by no means clear, that the greatest produce which such farms are capable of yielding goes to market. The great, and indeed the only, solid objection against large farms is, in his opinion, the consequent depopulation of the country. This, it will be generally acknowledged, is a most serious evil, and ought to be guarded against as much as possible. The remedy, however, in Scotland, he says, is easy, and in many places adopted; namely, by building cottages on the outskirts of the farms, and hiring ploughmen who are married and have families. These men are allowed grass for a cow, and a small quantity of ground for cultivating grain, potatoes, and garden-stuffs, in part of their wages. Were this plan generally introduced in both kingdoms, the grand objection against large farms would, he conceives, be in a great measure removed; the description of inhabitants would no doubt be changed; but the population would suffer no material decrease, and, at the same time, nearly an equal quantity of free produce would find its way to market.

Small Farms.—These are, no doubt, he says, advantageous to the proprietors, in so far as the greatest number of British farmers are possessed only of slender capitals; and, therefore, when small farms fall out of lease, several candidates immediately appear. The operations on the farm being for the most part conducted by the farmer's own family, the expense of hired servants is saved, and he is thereby enabled to give a higher rent than could otherwise be done, without changing the imperfect systems of agriculture too commonly practised on farms of this description. These advantages in favour of the proprietors are, however, probably fully counterbalanced by the imperfect modes of cultivation above alluded to: the additional expense to which they are subjected by upholding farm-houses on an estate let in small farms; to which may be added, the very great extra charge which must unavoidably be incurred in inclosing and subdividing an extensive tract of land into small fields. It is no

doubt of the interest of such tenants, that there should be a great number of small farms. The limited extent of their funds, and their knowledge and influence in the scale of society, would put it totally out of their power to embark in large undertakings of this nature; and if all proprietors were to adopt the resolution of letting no farms under a certain size, these people, as often happens, would be forced to turn their attention to some other employment, by which they could maintain their families. In a national point of view, small farms are, he thinks, undoubtedly advantageous. Large cities and towns are confessedly inimical to the increase of population, and would in time be in a great measure without inhabitants, but for the constant and regular supply which the country furnishes. Small farms are, he thinks, not only in favour of population, but of the most valuable sort of population; as, in consequence of the share of education which many of them obtain, the children of such farmers become valuable acquisitions to the artist and manufacturer. If, says he, small farms were entirely abolished, a great part of the occupiers must retire to towns, and engage in some branch of manufactures. At the commencement of every war, our manufactures receive a shock, from numbers of hands being called off to serve their country in our fleets and armies. Were this supply to be drawn chiefly from the towns, which in this case would certainly happen, what then would be the state of our manufactures, that great prop of national prosperity? In a word, it is owing, in no small degree, to the distribution of so large a share of the country into small farms, that the proper equilibrium of population between the towns and the country, so necessary to be preserved, is maintained. It is true, he says, that, owing to the number of persons of which the families of this class of farmers are generally composed, and the imperfect manner in which the lands are too frequently cultivated, a very small proportion of the great article of bread-corn goes to market. But the no less necessary articles of milk, poultry, eggs, and, in many cases, fuel, are furnished to the inhabitants of the towns and villages, in much greater quantities from half a dozen of small farms, than from one of six times the extent. To this list may also, he thinks, be added, butter and cheese, with a few exceptions only, where dairy-husbandry is practised on a large scale. It would, he conceives, be extremely difficult to determine, which of the sizes of farms before mentioned are in every point of view most beneficial. There is, however, says he, no occasion to hesitate in deciding, that a variety in the size of farms is not only for the interest of all concerned, but absolutely necessary for the prosperity of the state. Were the farms all small, the population of the country would exceed the due proportion of the towns, and the quantity of provisions which it would be necessary to import would be immense. If the country was wholly divided into large farms, and unmarried ploughmen principally employed, as is the case at present, the towns would be overstocked with people; and, unless the prices of cheese, butter, milk, eggs, poultry, fuel, &c. were advanced, so as to make it an object to that description of farmers to send them to market, a very scanty supply would be furnished. The diversity in the size of farms in the island is, says he, no doubt in favour of, and must be very agreeable to, the farmers; for, as they differ in knowledge and enterprise as much as in the extent of their captitals, they will naturally consider that farm as of the most proper size, which is upon the whole best suited to their particular circumstances and situations. Farms of the largest extent, the management of which a farmer is able himself minutely to superintend, must necessarily prove the most profitable; therefore, were the knowledge, enterprise, and capitals of farmers all alike, large farms would be considered by them as of the most proper size. There is, however, no view of the subject, by which it will be found, that any one size of farms would be generally advantageous. On the contrary, it is clear, he thinks, that the greater variety there is in the extent of farms, provided that variety is generally over every district in Great Britain, the more extensively will the general interests of the nation at large be promoted.

It has been ably remarked by the author of the Landed Property of England, in considering the dispute about the size of farms, that "one party asserts that all farms should be large, the other that all farms should be small. The first is, he says, chiefly composed of men of public spirit, who have turned their attentions to agriculture; and, having perceived that farms of magnitude, carried on by men of judgment, spirit, and capital, abound in corn and cattle of the highest qualities, conclude, says he, without examining further into the subject, that all farms ought to be large. The other party, coming forward with equal pretensions for the public good, consists of minor gentlemen, the clergy, and other professional men, tradesmen and others in middle life, who live in towns; and, finding the prices of poultry and eggs, and other good things, greatly enhanced of late years, imagine that the modern enlargement of farms must be the cause; and call out loudly for a division of large farms: in order, it may be fairly inferred, that articles of luxury may become plentiful:—not regarding, or perhaps not knowing, what an expenditure of poor men's food is occasioned by the rearing and fatting of poultry. The same barley or other grain which has been used in rearing and fatting a fowl, to supply one dish of an epicure's dinner, would, he says, have furnished a labourer's cupboard with bread, for several days." But, continues he, "admitting, what is obvious, that farms of magnitude, cultivated by wealthy and skilful men, furnish the markets with a greater proportion of the common necessaries of life, than small ones in the hands of poverty and ignorance, it is but common prudence to examine into the effects which would follow a general enlargement of farms, to be managed by wealthy men; and to conceive how the markets would be supplied, under such a regulation, before it be carried into effect."

If, says he, "at present (1801), when the country contains farms of all magnitudes, and cultivators of every description, there is a general cry against farmers, for keeping back their corn from market, what evil and outrage might not be expected, were all the lands of the kingdom in the hands of the wealthy? If the prices of grain after harvest should not meet their expectations, they would, in consequence, defer to thrash out more than for their own uses. And although they might have cause of repentance the ensuing summer, this would not relieve the distresses of the famished poor, in the mean time."

While, on the contrary, says he, "were all the farm-lands of the country, in the hands of the needy, the reverse would be the consequence. Presently after harvest, the produce would be hurried to market, too fast for the consumption; and the surplus would necessarily fall into the hands of dealers; who, besides reserving, on all occasions, an allowable profit, would have it in their power to fix their own prices, during the summer months." Of course, he supposes, that "either of these extremes would be productive of serious evil. What the community require, with respect to farm produce, is to have the markets regularly supplied, by the growers,—the immediate producers,—whether of vegetable or of animal food; without its passing through the hands of middle men,—unnecessarily." Hence, he thinks, "it is evident, that to obtain a regular supply of the corn-market, by the growers themselves, throughout the year, cultivators of different descriptions are requisite:—needy men, who want an immediate supply of money, after harvest, to pay servants wages and michaelmas rents: men without affluence, who thrash out their corn in the winter-months: and opulent, purse-proud, speculative men, to supply the markets, during summer and early autumn. And this most desirable order of things the country, he says, happily enjoys, at present, in a considerable degree." Nay, he thinks, that, "even admitting that the higher classes, who reside in towns, are intitled to the indulgences of luxury, out of the produce of lands, we still perceive the propriety of a gradation of farms: inasmuch as it furnishes large farms to feed the poor, and small ones to pamper the rich."

It is stated, that "though in a general view of the country, in this point, no great alterations are required;" when "examined in detail, it admits of some improvement, he says, in this respect. There are districts which abound too much in small farms, others in large ones; and some in farms much too large for accurate management" in any respect.

And it is added, that "if we view this subject in the light of good government, and the permanent welfare of the country, a similar gradation in the sizes of farms appears to conform with right reason. The tenantry of a country may, he thinks, be said to occupy the wide space in society, which intervenes between labourers and men of landed property; and, surely, they ought to form a regular chain between them. But make the farms of the country either uniformly large, or uniformly small, a number of links would be wanting. In the former case, particularly, a wide breach or chasm would be formed,—a void space,—between a numerous peasantry and their petty lords: a state of civilized society, this, which has no foundation, he believes, either in reason or sound politics:—which, he conceives, require a regular gradation from the peasant to the prince, and from the highest to the lowest in society; such a one as we fortunately find, in this country," at this time. And he concludes by observing, that "viewing the subject in a moral light, the present order of things appears to be nearly right. If farms were either uniformly large, or uniformly small, industry, frugality, and emulation (the sinews and nerves of society), would, among the lower classes in agriculture, lose their stimulus. If a farm-servant, or a labourer, saved a few pounds, or had fifty or a hundred pounds left him, he could not employ them in his own line of life. He would either dissipate them, live on them as an idler, or carry them into some other line of business. Whereas, at present, at least in districts in which farms of the smaller sizes still abound, there are many instances of servants, of the lowest order, rising to affluence, merely by the help of their own industry, frugality, and a natural spirit of emulation,—cherished and led on by the gradation of farms," which is a circumstance of much importance to society.

But as *large* and *small* are merely comparative terms, he thinks, "the extent of largeness, or greatest size, is the chief consideration; and this depends, in some measure, on the nature of the lands to be occupied, and the particular plan of management to which they are subjected. For it may, he apprehends, be safely assumed, that no man ought to occupy more land than he can personally superintend."

It is added, however, that "in a district applied to sheep-walks, farms of size are required; especially in a bleak or an open country, where sheep require constant attendance. A shepherd will take care of two or three hundred sheep, as well as of a smaller flock. And an active sheep-farmer, who knows his business, may well superintend several shepherds. Hence, in a passage of country applied wholly or principally to sheep-farming, individual holdings of more than five hundred pounds a year (estimated according to the present value of money) appear to him to be politically admissible." And "also in marshland districts, applied to grazing, farms of magnitude may be admitted. The occupier in this, as in the former case, has only one object; and, like a manufacturer of a particular article, or a man conducting one particular branch of trade, he may extend his business to almost any limits. But, that in districts and situations, in which the arable and grass-land management mix, or ought to intermix, the case is very different. For, here, says he, not only markets, and the management of stock of various species, require attention; but the seasons, or even a shower, may frustrate the best laid plan, and

render the master's presence necessary to accurate management." Here, continues he, "servants and workmen of various employments, working animals, and implements, call for hourly attendance in the field; while the different departments of the homestall demand almost constant superintendence, —equally to guard against negligence and dishonesty: in the winter-season, more especially; to see that every grain of corn and every handful of fodder is applied to its proper use; and that no waste, even of manure, is suffered to take place. During the spring and summer months, the corn farmer's time and attention are more required in the field; to see that every perch of ground he occupies is applied to some profitable purpose, or is put under a course of preparation for future crops; as well as to defend existing crops from enemies, whether animal or vegetable; to protect them equally from domestic stock, vermin, and weeds. In harvest, his constant and active exertions are called for;—not only to preserve his ripened crops, as much as in him lies, from injury by the weather; but from spoil and waste, by the carelessness of workpeople, in the various operations which they must necessarily undergo. And, in autumn, his most serious thoughts are wanted, to look forward to the general management of the ensuing year. All these attentions, and innumerable others, says he, the public have a right to expect from the occupiers of lands, in a country whose appropriated lands have been found, by many years' experience, to be insufficient, under the present imperfect state of its agriculture, to supply its inhabitants with the common necessaries of life." Thus, says he, "seeing the weight of care and forethought which every sufficient husbandman has to sustain, we may venture to conclude that there are few men who have attention and activity enough to manage, politically, more than five hundred acres of land, in a state of mixed cultivation, and worth, according to the present rental value of lands, five hundred pounds, a year; even though they lie compactly round one central farmery. It is not here meant, he says, that there are few men who are able to manage more than 500*l.* a year with profit to themselves. Many a man gets rich, with three times the property under his care: and lying, perhaps, in three distinct farms. But no wonder; for he may be said to be receiving three men's incomes, with only one family to maintain. If, through the inaccuracies and inattentions of management, he lose even half what two other occupiers would have gained, still he is doubling his own income, by holding three, instead of one farm. He gets two profits, Mr. Marshall says, and the community lose the third."

It is further stated, that "a farm of five hundred pounds a year, which is composed of inferior lands, as those which are worth ten shillings an acre, is too large for one man to manage, politically. A thousand acres lie too wide for one set of farm-offices. The great length of carriage of crops and manure, and the travelling of plough-teams and workmen of every description, to distant grounds, occasion a waste of labour; beside the waste of ground, by lengthened roads and driftways, and the injury done to stock, by a length of drift. And no man can superintend two homesteads, with political accuracy." But, says he, in order "to excite emulation, and to encourage men of capital, education, and spirit, to enter into and persevere in the profession,—to study its higher departments, and take the lead in practical improvements,—a small proportion of corn-farms of five hundred pounds a year, may be politically eligible." It is added, that "the lower extremity terminates in the cottage and its cow-ground; which may be set down at five pounds a year. This, however, is a sort of farm, which, like that of five hundred pounds a year, ought, he thinks, to be kept within bounds, as to number;—this being, of the two, the least political:—unless as the lowest step of the ladder of emulation. Thus, he says, in a public light, it appears to him that the sizes of farms, on lands of a good quality, and adapted to *mixed* cultivation, ought to extend from those of five pounds, to those of five hundred pounds, rental value. But that the proportional number, toward each extremity, ought to be small. For to his mind it appears, evidently, that it is from farms of the middle sizes,—as those of one to three hundred pounds a year,—the community receive the greatest proportion of the common necessaries of life. It is chiefly among the cultivators of farms of these sizes, that we find the three principal requisites of good husbandry; namely, capital, skill, and industry. On farms below these sizes, the first, and frequently the second, is wanting; and on those of higher magnitude, the last is, he thinks, apt to be deficient."

In respect to the advantages of different sorts of farms, it is observed by the author of the New Farmer's Calendar, that "were it demanded of him generally, What is the most advantageous application of land? he should be inclined to answer, That of dairying, or feeding a large number of cows for the produce of butter: but with the reserve, that the business be conducted with great variation from the common modes. The dairy-man must himself be a perfect judge of the live-stock which he entertains, and they of the improved species; no bad milkers must be kept, nor indeed any kept too long; the profit of grazing must come into the account, and of pig-feeding to a much larger than the usual extent. The winter-provisions for the cows, both green and dry, must be so ample, as to equalise the produce of butter, in money, at least, with that of the summer, and it will be clearly advisable to have a considerable breadth of land under the plough. If this, however, be the most profitable, it is, no doubt, he says, the most troublesome scheme of husbandry. The next in point of profit is, he thinks, two-thirds arable, one-third grass; the most advantageous winter-feed provided, and cattle enough of the best kinds kept to furnish annually from twelve to fifteen loads per acre of rich compost. This may prove more profitable than if all the land were grazed, since it is to divide the risk of markets between corn and cattle, and large crops of the former may of

might be expected, where the quantity of manure shall have been so liberal. A family which cultivates a parcel of land, with the prudent view of increasing its income and domestic comforts, should keep, he says, a small dairy, with two or three breeding sows, a small flock of sheep, some tame rabbits, and a few hives of bees. It should not be forgotten, to stock a fish-pond or two, if there be such convenience. The plan will also, he thinks, admit of the fatting a few bullocks annually.

"Hay-farms and grazing-farms are obviously, he says, attended with the least trouble. Hay-farming is, however, by no means the most profitable branch of husbandry, as it lies under the constant disadvantage of incapacity to feed live-stock to any good purpose, hence much after-grass is annually wasted. Granting a hay-farmer has fattened a lot of beasts, they must, he observes, be late in the season, when beef is usually cheap, and he cannot keep them until after Christmas, for fear of injuring his future crop of hay, which is his grand dependance. As to grazing, however profitable or void of trouble it may be, he would advise every person to be cautious how he enters into it, to any great extent, unless he shall have previously acquired a considerable knowledge of live-stock. Most bailiffs know, he says, much worse than nothing at all of the matter. In the common advice given on the head of breeding animals, aptitude of situation and room have always been very properly insisted on; but the consideration the most important perhaps of all others hath hitherto been neglected, which is, aptitude in the breeder himself for the undertaking, without which, he will venture to affirm, no adequate success ought to be expected. A man ought, says he, to be possessed of much sensibility for the brute creation, with a considerable spice of the *mania* of improvement, who sets up for a breeder. In his daily or weekly Bible-excursions, he must be sure never to forget the book of Job. He must enter fully into the spirit of a thousand little niceties, both of judgment and practice, which it would take a good volume to describe. He must find a pleasure in never-ending care and solicitude, and keep a perpetual watch. On such conditions, a breeder, he thinks, will acquire wealth and fame. The generality of cultivators, whatever may be their situation, had perhaps better purchase their live-stock ready made. With respect to fatting animals for market, the greatest difficulty, in his opinion, occurs with pigs, as is sufficiently manifest from the accounts of our numerous experimenters. The English of the matter is, he thinks, that the business requires a correct judgment, both of that species of stock and of the markets."

But whatever be the nature of the farm, it is obvious that it can never be cultivated to the greatest possible advantage without having the security of a fair equitable lease. See *Lease*.

On the conduct or management of farms, it is observed by the author of the Calendar mentioned above, that "it has always been the fashion to lay much stress on the difference between the gentleman and the labouring farmer, and to allow a decided superiority to the latter, nay, even to deny all possibility of the former deriving profit from the practice of husbandry. The matter has, he thinks, been improperly stated. Nothing can be more true, than that the man, whether gentleman or farmer, who determines to remain ignorant of his business, and who indolently suffers himself to be cheated through the nose, will have a fair chance to be everlastingly unsuccessful. But grant the gentleman a moderate portion of the science of agriculture, and a decent competency of activity and resolution, and he conceives the balance will preponderate even heavily on his side, whatever may be the quantity of lands, from a cabbage-garden to a farm of a thousand acres. The personal labour and superintendance of the mere common farmer, in the old beaten track, can never, he thinks, stand in competition with the advantages of the new husbandry, of the most productive kinds of live-stock, of an ample portion of manure, and of the garden cleanness of the hoe-culture. Agriculture, viewed in a trading light, perhaps, makes as ample a return for the use of money, as any domestic concern whatever; and although such be not the general custom, it is easy enough of proof, that very great capitals, to the amount of twenty, thirty, or forty thousand pounds, and upwards, might be safely and prosperously employed upon an extensive farm. The cultivator of two thousand acres, who should fully stock according to the principles of the new husbandry, breed and fatten his own cattle, consuming all his spring-corn at home, bacon his hogs, and meal his own wheat, would find occasion, he says, for sums of very high account. His articles being all those of the first necessity, and being without the obligation of allowing credit, the profits would be more certain, and the risks less, than in any mercantile concern. In what, he asks, consists the new husbandry, so often quoted by agricultural writers without a definition?—In alloting certain portions of an arable farm to the purpose of summer and winter feeding a stock of cattle, sufficient, with their dung, to manure and fertilise the whole of the land: in the eradicating, as far as possible, all useless vegetation with the hoe: in the use of the various improved or newly invented implements, for the purpose of expediting or abridging labour: and in the judicious selection of domestic animals. The usage of the old husbandry (too generally prevalent indeed, he says, at this hour) is to place very little dependance on the profit of live-stock, to feed very few, excepting those animals absolutely necessary for labour, to reject the hoe-culture, perhaps altogether, to foul the land by repeated corn-crops, and to clean it partially and insufficiently by summer-fallows, or seed in its foul state for a temporary ley."

There is, says the same writer, "a false pride amongst farmers of inferior property, which demands examination, if not correction. A man will make any shift, even to the neglect of the important advantage of purchasing cattle in the autumn, rather than sell his oats during harvest, or his wheat at

Michaelmas. His importance is much diminished, unless he can make a capital display of stacks. But fair and impartial calculation alone must be his guide in this case, who pursues his real interest. The profits of cattle, manure included, the waste in measure from the drying of the corn, and the consumption by vermin, must be strictly calculated, and set opposite to the probable rise of markets in the spring. In general, he pronounces, without hesitation, it is nothing short of madness for a grower of corn to hold it at a high price; and the most arrant and sottish stupidity for him to fix upon a flattering and imaginary rate, under which he will not sell. There is also another error in the management amongst farmers who have acquired property, which, he observes, has an extreme ill effect both upon their own and the public interest. As their money abounds, they have no idea but of purchasing into the funds, or of some other investment foreign to their proper concern: instead of which, their surplus cash ought to be invariably applied to the improvement of their farm, until their husbandry be complete; a mode of employment by which their money, instead of five, would, he asserts, earn them more than three times that rate, per cent."

Great care should always be taken that " the number of animals be properly adapted to the nature and extent of the farm, and that more be not kept than can be well fed or constantly employed. It is also of much consequence that the different sorts of land on the same farm be suitably proportioned to each other. The rate of stocking farms, in his opinion, may vary from three to fifteen pounds per acre. Many farms are taken by needy persons at the former rate; and if the soil be of natural fertility, the husbandry good, and the renter frugal and industrious, he may stand a fair chance, besides spending a life of cheerfulness, independence, and comfort, to enter the ranks of property before the expiration of his lease. Such are the peculiar and glorious privileges annexed to the cultivation of the soil! Sums of such magnitude as from ten to fifteen pounds per acre are, he says, of absolute necessity, either for stocking according to the new principles, or improving to any considerable extent."

On the stocking of farms, Mr. Young has thrown out many useful hints in his valuable Calendar of Husbandry. He remarks, that the advantage to be drawn " from the occupation of land, depends so much on the farmer commanding the requisite capital, that it is extremely necessary for the young beginner to be well advised on this essential point. If he is fixed in business by some experienced relation, he will not, he says, want the proper instruction; but as many adventurers (as they may be called) are every day making efforts to try their fortune in the culture of the earth, and many gentlemen taking farms into their hands, sometimes without due consideration of the necessary expenses, it is proper to" consider a few points in respect to the business.

He observes, that " thirty years ago, the sum that was usually appropriated to stocking a farm, varied from 3*l.* to 5*l.* an acre; and it was a general idea, that the latter sum was sufficient for any farm, part arable and part grass, of no uncommon fertility. Rich marshes were, of course, excluded in the calculation; and light flock-farms were often stocked for 3*l.* per acre. But these matters are now, he says, greatly changed; rents are much increased; tithes are compounded at a higher payment; poor-rates are enormously risen; all sorts of implements comprehended in the article wear and tear, are thirty or forty per cent. dearer; labour is in many districts doubled; the prices of cattle and sheep," as well as all other sorts of live-stock, " are greatly advanced; so that, at present, the same farm which at that period would have been very well stocked, and the first year's expenses provided for, at the rate of 5*l.* per acre, now demands near 7*l.* to 8*l.* per acre. But it is to be remembered, he says, that in all such estimates it is necessary to suppose that every implement bought in is new, and that the live-stock be good of the sort, and that the first year's expenses be provided for, though a portion of the crop may come in before the whole payment is made. A man, he thinks, cannot be at his ease if he does not thus provide; nor will he be able to make that profit by his business with a small capital which will attend the employment of a larger. By profit, he would be understood to mean, he says, a per centage on his capital, which is the only satisfactory way of estimating it. If, by stocking a farm with 5*l.* per acre, he makes seven or eight per cent. profit; and, by stocking in the proportion of 8*l.* per acre, he makes ten per cent. (and this difference will, he believes, often be found), it must be sufficiently apparent, he says, that the loss by the smaller stock is a serious evil. It will depend much, he thinks, on situation and local circumstances: the benefit of procuring manures, or litter to make dung, may, in some places, be very great, in others much less; but not to be able to profit by every favourable opportunity that may attend the spot on which a farmer is fixed, must, he observes, be highly disadvantageous to the former."

He further suggests, that " to irrigate land is an expensive operation; but to omit or postpone it, for want of money for the undertaking, is to lose, perhaps, the capital advantage of a farm. Cases of this sort might be greatly multiplied; and there is not one that does not call on the farmer for an ample capital to obtain the greatest possible benefit."

It is supposed, that of all the different sorts of farms, those of the warren kinds are hired with the smallest capitals; but there are marsh-lands in different districts, and especially in Lincolnshire stocked at the vast rate of more than thirty pounds the acre. And the general annual expense of many hop-plantations rises to thirty pounds, and the capital to more than sixty pounds the acre.

It is concluded, that if the farmer does not make ten per cent. on his capital, he must either have an indifferent farm, or there must be bad management, or the *times* must be much against him. He justly thinks, that he ought to make from twelve to fifteen

per cent; and some farmers, he says, make more even when the price of corn is not in any way extravagant. These observations are judicious, and should be constantly attended to by the young farmer in the business of stocking his farm.

In speaking of the laying out, and dividing farm-lands, so as to afford "the most profit to the proprietor," Mr. Marshall, in his useful work on the Landed Property of England, well remarks, "that much depends on the natural and acquired circumstances of every estate. Its situation, its soils, its present state of occupation, or system of management, and the present sizes of its farms, require to be maturely studied and duly weighed, before any effective steps can be safely taken. It is, he thinks, a more arduous task than the speculative and inexperienced may be aware of, to alter the arrangement or general economy of an estate, with profit and credit to its proprietor; even when the whole is rented at will, or from year to year. Where leases exist, difficulties are encreased: and the day of improvement is placed at a greater or less distance." But "nevertheless, says he, a man who has at his heart the permanent good of the estate he possesses, will look forward, and concert plans for its future improvement and welfare. And as an estate which is judiciously laid out into compact farms, of suitable sizes, is worth considerable more, by the year, than one of the same intrinsic value, whose lands lie scattered and intermixed, in farms of improper sizes, he will not fail to set on foot a plan of reform, which requires nothing but attention and perseverance to be accomplished." And he conceives, that "the first attention required is to study its natural characters,—to view it as in a state of nature, and without inhabitants,—marking the elevation and turn of its surface, whether it consists of mountain, upland, vale, or water-formed lands, and ascertaing, at the same time, its soils and substrata, with regard to their absorbency or retentiveness;—thus determining to what uses its several parts are adapted; whether to sheep-walk, or grazing-grounds, meadow lands, or mixed cultivation." And after "having surveyed the sheep-walk and grazing-ground, he should, he says, trace the natural and fortuitous lines of the culturable lands; as the feet of steep hills, the ridges of uplands, large rivers, public roads, &c. &c; these being data which cannot well be disregarded" in an undertaking of this kind.

He recommends, that "where a blank is given, such as an extent of newly appropriated lands, to lay them out into what may be termed natural farms, of such sizes as will bring the most permanent rent, at the least expense of buildings, yards, private roads, drift-ways, and fences. And to this end, the most natural, or eligible, sites for farmsteads are, he says, to be sought for with attention: laying to those which are most eligible, such lands as by natural situation, and natural quality, belong to them. Thus laying out the lands to the best advantage; and producing farms of different sizes: thereby inviting good farmers, with different capitals, to settle upon the estate."

And he thinks, "that the principal requisites of a homestall, for a farm in mixed cultivation, are shelter; and water,—for domestic purposes, as well as for the use of yard-stock; with some permanent grass-ground below the yards, to receive the overflowings of the dung-basons, that nothing of manure may escape off the premises. Where lands lie in a shelving situation, it is generally desirable to have the homestead near the midway of the slope. Thus gaining a central situation, and having lands above, as well as below, the yards; so that neither the whole of the crops, nor the whole of the dung, may require to be drawn against the hill at a busy season. A dip, or shallow valley, with a natural stream falling down it, and with lands in the lower part of it which are capable of being converted into watered mowing-grounds, is, he says, a desirable site for a homestead," in almost all cases.

It is however added, that "when an estate is already inhabited, and laid out into farms, with the farmsteads fixed, and the buildings substantial, it requires much thought and some time to make great alterations, either with credit or profit to its proprietor. Where the lands of different farms lie scattered, and intermixed with each other, as they too frequently do,—either through circumstances that were unavoidable, perhaps, at the time they took place; or through improper indulgences to favourite tenants; or through the ignorance or negligence of managers; or the less pardonable design of those who have had an interest in the dissensions which the intermixture of lands seldom fails to create;—something may generally, he thinks, be done towards remedying the evil; even where parts of an estate are under the temporary alienation of leases; through the means of amicable exchanges between tenants. This is, he says, a species of improvement which ought to be sedulously attended to, by the managers of estates; as lands which lie compact, and convenient to the homestall, are worth considerably more to an occupier, than those of the same intrinsic value, which are scattered at a distance; so that, by this sort of exchange, a twofold advantage comes home (or will come at the expiration of the lease or leases) a clear income, to the proprietor; beside rendering the management of the estate more easy and pleasurable." And that "in cases where the entire estate is rented, from year to year, the consolidation of farms may be effected with less difficulty; and the twofold advantage be immediately enjoyed" by the persons who hold them.

He farther advises, in order "to conduct the business of a general arrangement, regulation, or reform, of an estate, which is already laid out into farms, with full effect, to study it as a blank, in the manner that has been suggested, with respect to wild lands;—ascertain its natural or most eligible homesteads, and the lands which, by situation, belong to them. Then, to examine the existing farmsteads, buildings, roads, driftways and inclosures. And, by duly considering the aggregate of facts thus adduced, to endeavour to make out such a plan of improvement as will secure the greatest clear and permanent rent, at the least expense:—and this,

without driving from the estate the deserving part of the existing tenantry." And that "a plan of reform being fixed, let the intended farms be outlined and coloured, on a general map of the estate; and, this done, let each be separately delineated on a small map, suited to the pocket; that the proposed arrangement may be continually under the manager's eye; whether in the business-room, or upon the estate." He adds, that "this method of conducting a plan of reform (which he has repeatedly experienced) is equally applicable to an estate which is wholly at will, and to one which is partly under lease:—every favorable opportunity being taken, as the leases fall in, to carry the plan into execution:—always keeping it in view, from the time it is formed; and, in consequence, letting down buildings, or repairing them in a temporary way, where they will not be wanted; and keeping them up, in a substantial manner, where they will be eventually required." And that "where the farms are too large, or the farmsteads very improperly placed, but where the existing buildings are yet in a substantial state, it requires to be calculated, he says, whether the encrease of rent, by the proposed alteration, will pay six per cent. for the money required to be laid out in making it: taking into the account, however, the superiority of new buildings. The erecting of an entire suite of farm-buildings, with the requisite appendages, is, he says, an undertaking which, in private œconomics, demands mature consideration. There are cases, however, in which it may, he thinks, be effected with profit: and many in which it may be done with credit and respectability" to the persons employed in the business.

It is directed, that "where the farms are too small, suitable aggregations should be made; and each of these be coloured, on the maps, as one farm:—the alterations being afterwards made, as circumstances may direct: preference being ever given to the most deserving managers; and every fair opportunity taken to dismiss the undeserving. By this easy mean, giving the most impressive lesson on good management to the tenantry of the estate." The best effects are thus produced. He says, "it is to be further remarked, on the subject of laying out farm-lands into suitable tenements, that, although compactness of form, and centrality of homestall, are always desirable, they are not the only objects to be attended to. The specific qualities of the lands of the estate, is another subject of consideration. If the lands of an estate are naturally adapted to different purposes,—as cool strong lands fit for perennial mowing-grounds, especially if they can be profitably watered,—and dry uplands that are suitable for mixed cultivation, only,—a portion of each ought, according to long established ideas, to be included in every farm: a principle this, however, which is generally destructive of the compactness of form. And a more modern opinion is, he says, that perennial grass-lands are not at all necessary to profitable farming; cultivated herbage, and roots, being equal to all the wants of modern husbandry." But "nevertheless, where a suite of meadow and pasture-grounds can be properly united with arable lands, it will, he supposes, generally be for their mutual benefit to unite them. This, however, is to be done by a general arrangement; not by making up disjointed farms, with lands lying in distinct, and perhaps distant, parts of a parish; as we not unfrequently see. For the extra carriage of crops and manure, or the unnecessary and injurious drift of stock, and the waste of manure thereby incurred,—together with the mischiefs arising from stock being left at a distance from the eye, and the time lost in passing, on every occasion, between distinct parts of a scattered farm,—eventually fall on the proprietor," and are highly disadvantageous. In fact, he concludes, that "where an estate consists of arable lands of different substrata, so that some parts are retentive of moisture, others not, it ought to be the aim of the planner to include portions of each in every farm; in order that each occupier may have a regular succession of employment for his teams in a moist season; and in order that, whether the summer prove wet or dry, he may not be destitute either of grain or herbage. And, in districts of mixed strata, where a variety of lands are found, this, by due attention, may not unfrequently be done, without much deranging the compactness of the farms, or the central situation of the homesteads," by which vast advantage will be gained in the cultivation, crops, and convenience of the farms.

In the laying out the particular fields of a farm, Mr. Marshall has well remarked, that it must depend greatly on the situation, soils, and the system of husbandry, to which they are the most suited. There are, however, certain points or principles that deserve attention in this business. The great benefit of having a water-meadow below the farmstead, has been already seen. But where "a sufficient breadth of land cannot be commanded, in that situation, to become an object as a mowing-ground, to be watered superficially, the yard-liquor may, he says, be expended, with profit, on a smaller plot, converted to a farm *garden*-ground, to be watered by the means of parallel trenches, formed across the slope or descent of the ground, to receive it, in the manner described below; thus conveying the nutritious particles which have escaped from the dung-yards, immediately, to the fibrils of the plants, while growing; or to the base of the soil, into which they are required to strike." And that "on every farm (on which there is not a sufficiency of watered garden-ground) a *garden*-field of some acres, for the culture of green herbage and roots, with the plough, for horses, cattle, and swine, as well as for culinary purposes, ought, he says, to be laid out near the farm-yard." And "a *pasturing*-paddock, or two, near the house, is likewise a requisite appendage to a homestead; as a saddle-horse pasture, and as an hospital-ground, for ailing stock" of different sorts, as being convenient on many occasions.

It is likewise suggested, that "*dairy*-grounds, where the dairy is a principal object, ought, in like

manner, to be laid out near the house, and open into the lobby, green, or milking-yard," in order that it may be the more convenient. But that the "meadows, or perennial *mowing*-grounds, may be laid out at a distance with better effect, as it is always convenient to stack hay in the field of its growth. And, if not wanted near the spot, it may generally be brought home, with less inconveniency and expense, at almost any other time, than amid the bustle and hazard of hay-harvest."

It is added, that "arable lands, on the contrary, cannot lie at a distance with propriety; as, in this case, not only the crops and manure require a length of draft, but the time taken up, by the plough-teams, in passing to and fro, is a further inconveniency" of great consequence. Nor should the "*pasture*-grounds for working stock, whether oxen or horses (where these are pastured), be far from the homestall. But those for store-cattle and sheep may, he thinks, lie at a distance, with less impropriety" and disadvantage. And woodlands, such as "coppice-grounds, may also lie at a distance," without much inconvenience. It is evident, Mr. Marshall thinks, from this distribution, requiring much of the land contiguous to the farmstead, that there is an impropriety in very large farms, and an advantage in central farmeries.

It is observed, that in laying out arable lands, "the *number* of fields must constantly be regulated by the plan of management proper to be pursued; and by the size, as well as the nature, of the lands of the farm to be laid out. Where, as has been said, lands of opposite qualities, as those which are retentive of moisture, and those that are absorbent and open, are contained within it, in sufficient quantity, two suites of arable fields should be laid out; that the works of tillage and semination may not be liable to be interrupted by a shower; and that the stock of the farm, be the season wet or dry, may not be distressed for pasturage." And "on a large farm, whose lands are uniformly absorbent, and consequently adapted to the turnip-husbandry, it is proper to have more than one set of arable fields, in order that a sufficient choice of contiguous or near fields may be had, over which to distribute the turnip-crop (where this mode of husbandry is proper to be practised), and thereby prevent an unnecessary length of carriage." Likewise, "on rich retentive lands, in situations where an ample supply of extraneous manure can be procured, or where such lands are united with marsh and meadow-grounds to furnish a sufficiency of hay and pasturage, without the assistance of the arable lands, one set of arable fields may be sufficient; four or five fields or divisions being all that is necessary; at least on a small farm. But that on the generality of English farms, on which a number of manure-making stock are necessary to be supported by the arable lands, a greater diversity of fields is, he thinks, required; as, in this case, it is necessary that the lands should lie some years in a state of cultivated herbage between each course of arable crops; according to its nature, and the time it will lie profitably in a state of grass; as two, three, four, or five years." Of course, "if the arable rotation occupy the land four years (taking three crops of corn with a fallow-crop, or fallow, intervening), the number of arable fields required, for one set, will be six, seven, eight, or nine. However, much depends, he says, in all cases, not only on the nature of the land, but on the calcareous and other extraneous manures, which may be procured, in greater or less quantity, in almost every situation" or district.

It is suggested, that "the sizes of arable-fields may seem to be given in the number. But on a large farm, in a bleak situation, and on which it is proper to keep a numerous stock, it may often be found requisite to subdivide the arable divisions, not only for the sake of shelter, while the lands lie in a state of herbage, but for the conveniency of separating, and shifting stock. Hence, it is incumbent, he says, on the planner of a farm, to weigh well the various circumstances that belong to it; as on these, only, the true size and number of arable fields can be calculated." And he adds, that "even the shape of an arable field is not a thing of arbitrary choice. It ought, he thinks, to be regulated by the shape of the farm, and by the roads and water-courses running through it, as well as by the nature of its lands, the turn of its surface, and its aspect or exposure. A square, or a long square, is, he conceives, a desirable shape, where circumstances will admit of it. Crooked lines, and irregular figures, are inconvenient in the operations of tillage, and should be avoided. Two sides, at least, ought to run parallel with each other. And it is, he thinks, equally or more desirable, that each field should have a uniformity of soil and subsoil, as on these depend the uses to which it is applicable; and it is, at once, unpleasant and unprofitable, to have different parts of the same field under separate courses of management. Yet, says he, where the natural line of division is very irregular, it is improper to follow, implicitly, all its windings. The planner ought, he thinks, rather to draw a judicious line between the two, and the cultivator to alter the qualities of the lands,—which happen to be unnaturally severed,—by draining manures," and other similar means.

He supposes, that "the direction of arable fields should be the same as that in which the land ought to be ploughed for a crop, provided it be compatible with the given lines of the farm. On a level surface, or on one which is gently inclining, the direction of the beds of retentive lands that require to be laid up in round ridges, ought to be nearly north and south: in order that the crop, on either side of them, may receive equal sun, and ripen evenly. Consequently, in this case, the fences, which form the two longer sides of the quadrangle, should take that direction" as much as possible. But that "where the surface is steep, this principle of direction must, he says, give way to another of greater utility." Where "the land is retentive, and the soil requires to be laid up into round beds, across the slope, the direction of the ridges must be guided by the face of the slope; and the fences, on the

general principle, ought to take the same direction: observing, in this case, where circumstances will permit, to let the fences wind to the right of a person standing on the brink of the slope, and facing towards it; as the beds ought to take that direction, for the greater ease in ploughing them" for different sorts of crops. And where " the face of a hill is steep, and the land absorbent, the soil requires to be turned downward of the slope, with a turnwrest or Kentish plough; and the fences to be directed by the natural lines of the hill," as much as can be done with propriety.

It is likewise advised, " in laying out perennial *pasture*-grounds, such as cow-grounds and grazing-grounds, that regard should be had to water. And wherever good water is naturally found, or can be conveniently brought by art, to that point, a pasture-ground ought to tend; in order to enjoy the necessary supply" as much as possible at all seasons.

With respect to the " laying out water-meadows, where they are situated on sloping grounds, or whose higher sides adjoin to upper lands, the main conductor (where a proper fall from the source of the water will admit of it) ought, he says, to define the outline of the meadow on that side; and the fence which separates the meadow-lands from the dry grounds, ought to run immediately along the upper side of the water-course: the two thus becoming mutual guards to each other," which is a circumstance of much importance in many cases. It is however here remarked, that " within an extended flat, or an extent of gently shelving meadow-grounds, belonging to different proprietors, and where deep ditches are required to be sunk on the upper sides of the fences, to drain the lands that lie above them, the plan here recommended would be improper. But, in the situations above described, it is perfectly eligible; and ought not, in ordinary cases, to be departed from."

In conclusion, it is well remarked, that in " regard to drift-ways and private roads, where a public road runs through a farm, the more distant fields ought, under ordinary circumstances, to open into it: to prevent the interior of the farm from being cut up, unnecessarily, by carriages, or poached by stock, or laid waste by unnecessary private roads and drift-ways; which encrease the number of fences, and are made and kept up at considerable expense. And that, where public roads do not present themselves, private lanes are highly requisite, especially within large farms."

All these circumstances require to be carefully considered by the persons employed in this sort of business. And Mr. Marshall further judiciously suggests, that " whether in laying out an estate, or a farm, it is prudent to go repeatedly over the ground; with a map of unalterable data in one hand, and a list of desiderata in the other; and with the leading principles of the art, in the mind; but without any preconceived general plan in view: ever letting the particular circumstances of the lands to be laid out, determine the true points to be fixed, and the proper lines to be drawn; acquiring correct ideas of outlines, by enlarged surveys; and, by more minute examinations, adjusting particular points." By this means, lands may be laid out in the most advantageous and proper manner.

Letting of FARMS, the business of providing suitable tenants for them, which is obviously a matter of the utmost importance to their success, and that demands the fullest consideration. The income of the proprietor is not only materially concerned in it, but likewise his character and comfort. It therefore behoves land-owners to be extremely attentive and circumspect in the accomplishing this point.

It has been observed by the author of the Treatise on Landed Property, that there are three modes of letting farms; as by public auction, the highest bidder being the tenant; by written proposals, the highest offer having the farm; and by the asking of more rent than the farm is worth, so as to close with the person promising the largest rent, without regard to his qualification as a tenant.

It is added, that " for a manager who is equally unacquainted with the value of lands, and the qualifications of cultivators, these, he thinks, especially the two first, are ready and easy methods of tenanting a farm. And if, says he, by a silly custom of the estate under his care, he has a profit on leases or agreements for farms, this mode of letting becomes still more agreeable to him. For it is three to one that either the farm is let too dear, or that the tenant is unequal to its management: consequently, there is a fair prospect (to the lease-drawer) of its being to be re-let, in the course of a few years. If he has not only a handsome profit upon every pair of leases, but is allowed to take (or is accustomed to take) fees of entry, his prospect becomes still brighter. And if, added to these, he has a further profit upon deeds of distress and surrender, who can blame a man, that has perhaps an amiable family to support, for letting a farm by auction or by proposals; or for agreeing with an adventurer, or with any man as ignorant as himself of its true value, for more than it is worth; or for screwing up the tenant in possession, to a rent he can never pay;—when he knows, perhaps, that by so doing he shall not only enhance his income, but gratify his employer?" It is, he justly remarks, " the employer, not the agent, who, under this false principle of management, is playing the losing game! Excessive rents are only nominal. They look well, says he, on a rent-roll,—while they have a right to stand there. But if the arrears be received through the distress and ruin of the tenant, the injury done to the estate (not to mention its loss of character) is to be deducted from the nominal rent. At length, when the lands are completely exhausted, the buildings let down, the gates and fences broken, the water-course choked up, and the roads impassable, the tenant runs off,—and the farm lies unoccupied,—a very blank in the rent-roll!" Such is the impropriety of this method of proceeding in the tenanting of the estates. He supposes, that to " the life-tenant of an estate, who has no interest whatever in the remainder, and whose life is worth but a few years' purchase, such a mode

of proceeding might claim a sort of justification." But, that "in the possessor of an hereditary property, which is expected to descend to the son, and son's son, such an improvident practice becomes, he thinks, altogether irrational. It might, he observes, be deemed an act of folly, in a young man; and of cruelty, as well as folly, in one of riper years; whose successor might thereby be involved in perpetual difficulty;—and his own memory, in consequence, be shrouded in disgrace." He has, in his various examinations, and reviews, of the different departments of the kingdom, seen much mischief and misery resulting from this impolitic plan of management, in letting farms.

He thinks, that if "the intimate connexion which subsists—which must subsist—between owners and occupiers be well considered, and how much the interest of the former depends on the conduct of the latter, it is but common prudence to be scrupulously attentive to the choice of tenants." And further, that as, "in every situation, there is, at all times, a fair rental value, or market price, of lands, as of their products, there appears to be only one rational, and eventually profitable, method of letting a farm;" and that is, by *fixing* the *rent*, and *choosing* the *tenant*.

In this method, there is the greatest chance of having a proper tenant in so far as the cultivation of the land is concerned, and at the same time of having the rent duly paid.

FARM-*Buildings*, such buildings and offices as are necessary for the various purposes of farming. The nature and construction of buildings of this sort must obviously be different, according to the kind of farm, and the particular modes in which it is managed. In general, an arable or corn-farm will require more extent of buildings than those of the dairy, grazing, or hay kinds: but, whatever the nature of the farm may be, the extent of the buildings should always be ample, and fully sufficient for every use. The kinds of buildings that are most generally required will be *farm-houses*, *barns*, *granaries*, *stables*, *cow-houses* or *cattle-sheds*, *calf-pens*, *root-houses*, *straw-sheds*, *hog-styes*, *chaff-houses*, *poultry-houses*, *cart-lodges*, *harness-rooms*, *tool-houses*, &c. See these different heads.

It is asserted by Mr. Beatson, in an useful paper in the first volume of Communications to the Board of Agriculture, that the construction and arrangement, together with the situation, of farm-buildings, are objects of so much importance to the practical farmer, that they merit the most particular attention. On a judicious combination of these, the facility of carrying on his various operations, he says, in a great measure depends. Yet how few, says he, are the examples we meet with of farm-offices either commodiously planned, or judiciously situated. Whether we view this subject as relating to the landlord, to the tenant, or indeed to the public at large, it appears highly interesting. To the landlord, it is a matter of a considerable moment, a part of his rents very often depending upon it; for it is natural to suppose that a tenant, especially on a long lease, would give more for a farm if the house and offices were commodious, than if they are so miserably deficient as most farm-offices are. He would even be the more readily induced to take a farm on that very account; and thus the landlord may often lose a good tenant, merely by not having proper accommodation for him. He has heard farmers declare, that they would willingly agree to pay five per cent. or more, on the expenses laid out on commodious buildings, over and above the rent of the farm, rather than occupy for nothing those they at present possess; and that they would, besides, undertake to be at the expense of every ordinary repair during the continuance of their lease. How then, says he, can a landlord lay out a few hundred pounds to better purpose than to accommodate his tenants, if he gets not only five per cent. on the money thus laid out, but (provided his buildings are very complete) perhaps as much additional rent as will amount to five per cent. more? He is well convinced, that the great expense of erecting new farm-buildings in the usual way, is a very material obstacle to altering the present form; for there are few landlords, he supposes, who would choose to lay out five or six times the rent of a farm in new accommodations for that farm, if by propping and patching they can, at a small expense, make the old buildings answer. When, says he, we hear of 500*l.* being expended in building a barn on a small farm of about 100*l.* rent, as is the case in some parts of England, and 1000*l.* laid out on a farm-house, it is no wonder that landlords are cautious of engaging in such buildings; and it cannot be supposed that tenants would be mad enough to do so. Hence, perhaps, is the principal reason why the generality of farm-houses and offices are in so ruinous a condition. But when farmers can be persuaded that such enormous barns are unnecessary; that their corn can be kept much more secure, and less liable to injury, in a well-aired rick-yard; and that if they have just room enough in their buildings for all the common purposes of the farm, no more is requisite; also, that a neat, small, commodious dwelling-house is fully more comfortable than a large dismal one; then we shall find, he thinks, that landlords will more readily agree to accommodate their tenants; and that, instead of these gloomy, preposterous, ruinous buildings, now a disgrace to almost every part of the kingdom, we shall behold neatness and uniformity, combined with every necessary accommodation; which will afford not only pleasure and comfort to the occupiers, but a beauty and an ornament to the country at large. That this may be accomplished at a very moderate expense, he hopes to be able to prove. So far as any general rule can be given upon this subject, and allowing for circumstances and the variation of prices, he is fully persuaded, by the observations he has made in different parts of the kingdom, that in general one year's rent of a farm, if not under 70*l.* (or at most two), is amply sufficient for building every accommodation necessary upon that farm, exclusive of the dwelling-house; and that one year's rent is enough to build a dwelling-house on all farms

not exceeding 400*l.* a-year (in many situations less may do); and, lastly, that 500*l.* are sufficient for a dwelling-house, and 1000*l.* for offices on a farm of any extent. It is likewise observed, that, in building new farm-houses and offices, a great saving of expense will accrue by making use of all the serviceable materials in the old buildings, where such buildings are; and it will astonish many (provided they are fairly dealt with) who have been accustomed to those large, unnecessary, and expensive buildings commonly used, at how small an expense, comparatively speaking, a new set of offices or house may be built, having the advantages of such materials near the spot. Workmen, in general, are much averse to using old materials, especially carpenters, who, rather than run the risk of touching a rusty nail with a hatchet or saw, will put their employer to the expense of some hundreds of such tools, by condemning the old, and advising him to purchase new timber.

To a tenant, the construction and arrangement of his farm-buildings is a matter, he says, perhaps of more importance than even to a landlord. After all his toils and labours, and the many anxious and sleepless hours he has passed before his crop has come to maturity, if his offices are insufficient, or improperly constructed, he still runs the risk of many inconveniences, and even real loss. The security of his grain, the labour and the value of his horses and other cattle, the safety and duration of his implements, are all dependent on the perfection or imperfection of his offices. By arranging them judiciously (a matter very little attended to), a great deal more labour may be obtained from his servants, and every operation on the farm will be carried on with more facility and dispatch; for, if a barn is set down here, a stable there, a cow-house or feeding-house in another place, all without rule or order, and as if chance had set them down, much unnecessary labour will be occasioned, and a great deal of time lost in carrying provender to the cattle, and in keeping them so clean and dry as is necessary towards their health and preservation.

Farm-buildings, as has been remarked above, should always, he says, be proportioned and constructed according to the size and produce of the farm; which, in settling their dimensions and arrangement, must be particularly taken into consideration. If, for example, the farm is adapted entirely to grazing, very few buildings will be necessary, except some sheds; and these will be in use chiefly during the winter-season, temporary ones being often erected in the fields for the summer. On farms where cattle are housed only in winter, or in such farms where more buildings are used in winter than in summer, a great expense in roofing may be saved in cattle-sheds, by erecting walls only, or having pillars or posts placed and framed in such a manner as to support peas, hay-ricks, or any other sort of ricks that are not intended to be taken down till the spring or summer. This will not only answer the purpose of an excellent warm roof, but will be a very good situation for building such ricks. If, however, the farm is entirely for grazing, as before supposed, there may not be a sufficiency of ricks, unless of the fodder for the cattle, to make such temporary roofs. In that case, the sheds must of course have permanent ones, which may be of the cheapest construction. Or, if there should be a sufficient number of boards about the farm, as is sometimes the case, they may be laid loosely on, to serve as a roof to the sheds, till wanted for other purposes.

A dairy-farm, says he, will require a different sort of accommodations, being in general composed partly of the grazing, and partly of the arable kind. The cow-houses must be proportioned to the number of cows usually kept, with every other accommodation for carrying on the dairy business, whether as a cheese or butter-farm. Small stables, and a small barn, are sufficient for such a farm. But in an arable or corn-farm, which generally partakes of both the other sorts, the buildings must be more numerous, and suited in some respect to all these different purposes: the stables, in proportion to the number of horses or cattle requisite for labouring the farm; the cow-houses and feeding-houses, according to the number of cows generally kept, and cattle fed; the barn and granary according to the extent of arable land; together with all the other usual accommodations for breeding young horses or cattle, for hogs, poultry, &c. all which must be particularly considered of while planning the farm-offices.

However, since the invention of thrashing-mills, a most material alteration may, he conceives, be made in the construction of farm-buildings, particularly in barns. The tedious and laborious operation of thrashing with the flail made it, says he, necessary to have the barn large enough to hold a great quantity of corn in the straw, or at least to contain a whole stack at once; and, besides, to have it so lofty as to give sufficient height for raising the flail. This is by no means necessary where there is a thrashing-mill; for as the mill, if properly constructed, will thrash the corn as fast as taken in, it is unnecessary to throw in the whole stack at once; and what remains of it in the rick-yard, if any, may be covered with a tarpawling, or painted canvas, for that purpose; a thing that every farmer ought to have, being of essential use, either in case of a sudden shower in harvest, when building a stack or hay-rick, or of leaving one unfinished at night, or any other time. A thrashing-mill not requiring so lofty a barn as a flail, a very convenient granary or store-room may be obtained above the mill, which, in the common way, could not have been had. In short, the advantages of a thrashing-mill are so numerous, that no farm producing 1000 or 1200 bushels of grain annually, should, he thinks, be without one. See *Granary*, and *Thrashing-Machine*.

It is farther observed, that, when the plans of any farm-buildings are finally determined on, there are many preliminary considerations necessary to be attended to, previous to the commencement of the work. The situation with respect to the quality of the air, the water, materials for building, access

and exposure, the soil for laying the foundations upon, the best method of conducting the drains, together with the expense of completing the whole.

Mr. Beatson observes, that in antient history we are told that the Romans were so very attentive and careful in the choice of a good and healthy situation, that they would not even encamp upon a spot of ground till they tried various experiments to ascertain if it was sufficiently healthy. How much more necessary, then, is it, says he, to ascertain the salubrity of a place destined for more permanent purposes. In general, where a choice of situation can be had, these four things should, he thinks, be particularly attended to: a pure and temperate air; the water wholesome, and easily come at; the soil dry; and the place centrical, and of easy access. No buildings whatever require, he says, these qualifications more than farm-buildings; yet, in general, it would appear they had been totally disregarded. How often do we see farm-buildings and barn-yards placed in the very worst situation in a whole farm; in low, marshy, boggy spots, almost inaccessible to man or beast, and fit only for a resort for frogs and wild-ducks. Perhaps too, within a little distance, a fine, dry, wholesome situation might have been obtained; for there are few farms, of any considerable extent, in which a tolerably good situation for building may not be found somewhere. If dryness and purity in the air are so desirable and requisite for the site of a dwelling-house, how much more (if possible) are they necessary for farm-offices and barn-yards. If these are placed in a damp and humid spot, the farmer's whole crop runs the risk of being rendered useless and unsaleable, however dry and well-conditioned he may have brought it from the field; for, if the place to which he brings it is damp and unwholesome, his grain will soon acquire a softness, and perhaps mustiness, very injurious to its value. On the other hand, if the situation is dry, his grain will not only improve and keep in better order, but in general it will be of a better quality, and consequently worth a better price at the market.

In fixing the arrangement of a new set of farm-buildings, the first thing, he says, to be taken into consideration, after choosing the situation, is the nature and produce of the farm. From these may be judged the different kinds of accommodation that will be neccessary. For example, every farm must have, 1st, a dwelling-house; 2dly, a barn suitable to the extent of arable land in the farm, either with or without a thrashing-mill, but always with one, if possible: and it should be endeavoured to place it so that it may go by water, if a supply can be had; 3dly, stables, the dimensions of which must be determined according to the number of horses necessary for the farm; 4thly, cow-houses, or feeding-houses, or both, according to the number of cows and cattle, and so on, till the whole accommodations necessary, and their dimensions, are fixed upon. Having ascertained these, and the situation for building on being also settled, the ground must be carefully and attentively viewed; and if not very even, the different levels must be observed, and the best way of conducting all the necessary drains, and carrying off all superfluous moisture. Also the best situation for dung and urine-pits, or reservoirs, which will, in a great degree, ascertain at once where the cattle-houses and stables should be. These being fixed on, the barn should, he observes, be as near them as possible, for the convenience of carrying straw to the cattle; and the barn-yard should be contiguous to the barn. If a granary is resolved on, that should also be near the barn, or over it; as likewise the straw-house, which should be close to the barn. These main points being determined on, the others will easily be found; always observing this rule, to consider what is the nature of the work to be done about each office; and then the easiest and least laborious way to perform that work, so far as it is connected with other offices. In case this should not be sufficiently explicit, he shall suppose, by way of illustration, the situation of a feeding-house is to be considered of. The nature of the work to be performed here is, bringing food and litter to the cattle, and taking away their dung. The place from whence the greatest part perhaps of their food and all their litter comes, is the barn; therefore the feeding-house should be as near the barn as possible. If turnips or other roots, or cabbages, make a part of their food, the most commodious way of giving these must be determined on; whether by having a root-house adjoining the cattle-house, and that filled occasionally, or by having a place to lay them down in, near the heads of the stall, from whence they are thrown in at holes in the wall left for that purpose. The easiest method of clearing away the dung must also be considered, according to the different plans mentioned when describing cow-houses, cattle-sheds, &c. (see *Cow-house*, and *Cattle-shed);* and the same general rule being observed in determining on the site of all the other offices or accommodations, together with a careful examination of the ground to be occupied (upon which the arrangement of the offices in a great measure should depend), any person conversant in rural affairs, who attends to these particulars, and can lay down his ideas in a drawing, may, he thinks, easily direct the planning and building of a very commodious set of offices. With respect to the site of the dwelling-house, in addition to what has already been said, it may be remarked, that, although a house being situated in the middle of a regular front is, in some points of view, the most pleasing way, and in many situations perhaps the best, yet, unless the ground and other circumstances in every respect favour such a disposition, he would not invariably adhere to it; for it may often happen, he thinks, that a much better situation for the dwelling-house may be obtained at a little distance from the offices, and a pleasing uniformity enough be observed in them at the same time.

In some cases, and for some kinds of farms, it may be particularly necessary to have the house so placed, in respect to the offices and farm-yard, as to admit of their being constantly inspected, and the

labour that is to be performed in them attended to and overlooked.

It is well remarked by Mr. Marshall, in his work on Landed Property, that "the particular requisites of a farmstead are as various as the intentions of farms. A sheep-farm, a grazing-farm, a hay-farm, a dairy-farm, and one under mixed cultivation, may require different situations, and different arrangements of yards and buildings. On a farm of the last species, which may be considered as the ordinary farm of this kingdom, the principal requisites are, he thinks, shelter, water, an area or site sufficiently flat for yards and buildings; with meadow-land below it, to receive the washings of the yards; as well as sound pasture-grounds above it, for a grass-yard and paddocks; with private roads, nearly on a level, to the principal arable lands; and with suitable outlets to the nearest or best markets." The first of which when wanting, in the desired situation, may in time be supplied by plantations and mound-fences. And where there is not a natural supply of water, a well, water-cellar, or artificial rill, may, he says, furnish it.

It is added, that "grass-lands are easily produced, in almost any situation; and, by the help of enriching water, or by manure and pasturage, may in most be rendered perennial," or in a state of continuance.

From this it "is plain, he thinks, that no general plan can prevail. Even on what may be emphatically called an *English farm*, composed of arable, meadow, pasture, and wood-lands,—the plan of the farmstead must ever be moulded to the main object of the farm, whether it be corn, the dairy, rearing cattle, fatting cattle or sheep; as well as to its size; for although the same, or nearly the same, species of conveniences are required, on a small, as on a large, farm of the same intention, the number may be less; and the arrangement be made on a more frugal plan." And "in this, as in every other matter of arrangement, the first thing to be done is, he says, to ascertain the particulars to be arranged," which "for a farm under mixed husbandry, may, he says, be thus enumerated: namely, 1. A suit of buildings, adapted to the intended plan of management,—as a dwelling-house, barns, stables, cattle-sheds, cart-shed, &c. &c. &c. 2. A spacious yard, common to the buildings, and containing a receptacle of stall-manure, whether arising from stables, cattle-sheds, hog-styes, or other buildings: together with separate folds, or straw-yards, furnished with appropriate sheds, for particular stock, in places where such are required. 3. A reservoir, or catchpool, situated on the lower side of the buildings and yards, to receive their washings, and collect them, in a body, for the purpose of irrigating the lands below them. 4. A corn-yard, convenient to the barns; and a hay-yard, contiguous to the cow or fatting-sheds. 5. A garden, and fruit-ground, near the house. 6. A spacious grass-yard, or green, embracing the whole, or principal part of the conveniences; as an occasional receptacle of stock of every kind; as a common pasture for swine, and a range for poultry; as a security to the fields from stock, in straying out of the inner yards; and as an ante-field, or lobby, out of which the home-grounds and driftways may be conveniently entered."

And in respect to the distribution or management of these different objects, he remarks, that in order to make it with good effect, great caution, study, and patience, are required; that the most may be made of given circumstances. "An accurate delineation of the site which is fixed on, requires, says he, to be drawn out, on a scale: the plannist studying the subject, alternately, upon the paper, and on the ground to be laid out; continuing to sketch and correct his plan, until he has not a doubt left upon his mind; and then to mark out the whole upon the ground, in a conspicuous and permanent manner; before the foundation of any particular building be attempted to be laid." It may, he thinks, be naturally "conceived, by a person who has not turned his attention to this subject, that there must be some simple, obvious, and fixed plan to proceed upon. But seeing the endless variety in the mere dwelling-places of men, it is not to be wondered at, if a still greater variety of plans should take place, where so many appurtenances are required; and these on sites so infinitely various: nor that men's opinions and practices should differ so much on the subject, that, on a given site, no two practical men, it is more than probable, would make the same arrangement." There are, however, he says, "certain principles, which no artist ought to lose sight of, in laying out" such buildings and conveniences. "The barns, the stables, and the granary, should be under the eye, —should be readily seen from the dwelling-house." And "the prevailing idea, at present, is, that the several buildings ought to form a regular figure, and inclose an area or farm-yard; either as a fold for loose cattle, or, where the stalling of cattle is practised, as a receptacle for dung; and the most prevailing figure is the square. But this form is, he thinks, more defective than the oval or circle, the angles being too sharp, and the corners too deep. Besides, the roadway, necessary to be carried round a farm-yard in order to have a free and easy passage between the different buildings, is inconveniently lengthened, or made at greater expense. The view of the whole yard, and buildings, from the house on one side of it, is likewise more confined."

He had formerly suggested the plan of a polygon, or many-sided figure, or an irregular semi-octagon, with the dwelling-house and stables on the largest side, having ranges of cattle-stalls opposite. But has since formed one on the complete octagon, the dwelling-house being on one side, and the entrance gate-way and granary opposite, the remaining six sides being occupied by stables and cattle-sheds, with a broad-way dipping gently from the buildings, and surrounding a wide shallow dung-dish, which take the rest of the area of the yard. This is given as a hint to those engaged in laying out, and directing buildings of this sort, which they may adapt to the particular nature of the site or situation of such erections.

It is further remarked, that it is not necessary to follow any particular form or figure. The sides may have a greater or shorter length, according to the site and intention of the builder. The site should be nearly, but not entirely, level; the principal yard being formed across the descent; having the barn on the higher, and the stables on the lower, sides: as in this way the barn, stack-yard, straw-yards, cow-stalls, and dwelling-house, will have a dry situation; while the road that leads into the yard, and to the carriage-sheds, will be on the level ground.

With respect to the dwelling-house, the proper situation must, in some degree, be directed by the extent or size of the farm. Where it is small, for the labouring farmer, it may be placed at the north end of the yard, facing into it, and be approached through it. As the kitchen is the chief room in which he resides when at home, and in which his wife performs most of her domestic business, the yard, the buildings, and the stock in the yard, will be constantly under the eye. But in an extensive farm, where a yard-man is kept to attend the stock in winter, and where the house-work is mostly done in the back-kitchen and dairy-room in the summer, and where the farmer is desirous of entertaining his friends with a more agreeable prospect than a farm-yard, the house may occupy the south end of it, facing into the garden, and have a separate approach in front. But the writer remarks, that the first mode of distribution gives a desirable shelter to the yard, while the latter leaves it exposed to the north winds, which blow through the entrance and open carriage-sheds. In either case, it is screened from the east winds by the barn and cattle-sheds. It is also of advantage to have the house fronting to the south, in order to give coolness to the dairy buildings. But since the introduction of threshing-mills, in the place of threshing-floors, the barn is become quite different, requiring another form, arrangement, and situation. One end of it should, in these cases, be placed towards the farm-yard, instead of the side, which is proper in the contrary circumstances; the other end being towards the stack-yard, to which it should be connected, with a rail-way for removing the corn upon to it; having a lean-to shed and straw-yard on the sides where they may be necessary.

These barns should be large enough to contain a good quantity of grain at a time, for threshing out in wet weather. See *Threshing-Machine* and *Barn.*

It is added in conclusion, that the small angular room-steads between the ranges of sheds, may be formed into convenient places for containing fodder, roots, &c. and for the keeping of calves, &c. &c.

There should also be a receptacle for the stall-manure, which should be properly formed and connected with the stalls by proper drains; and a reservoir for the reception of the yard-liquor, where it cannot be turned upon the land below, is of much use. See *Farm-yard.*

FARM-*House*, that kind of house which is attached to a farm, and which is constructed for the purpose of carrying on the business of it. Houses of this sort ought not only, Mr. Beatson observes, to contain every conveniency for a family, but should have a degree of neatness and uniformity, which, if properly managed, will, he thinks, cost no more than a dull irregular building. Columella says, he remarks, that "a farm-house should be somewhat elegant, to give pleasure to its possessors, and to allure the wife to take delight in it. It should be built on the most healthy spot of the farm, in a temperate air, such as the middle of a hill commonly enjoys, where it is neither stifling in the summer, nor exposed to the rage of winds and storms in the winter." The size of a farm-house should be regulated by the size of the farm, although not so strictly so as the other buildings; a parlour and kitchen, with dairy, closets, and other conveniences, below stairs, and the upper story divided into bed-chambers, are probably sufficient accommodation for any farmer's family. These may be contracted or enlarged, according to circumstances, or to the inclination of the proprietor: but it is better to give a little more room than necessary, than not to give enough. None of the buildings about a farm, he says, admit a greater latitude of construction than the farm-house; for sometimes a very small house may do for a very large farm; at other times it would require a pretty large house on a small farm, according to the size of the farmer's family, and, perhaps, to the situation in life he has been accustomed to; for there are many very respectable and worthy farmers whose manners and conversation entitle them to the best accommodation; and it sometimes happens that a landlord will consider this, and build a house for the farmer instead of the farm. There is something, he remarks, so pleasing in the appearance of neatness and cleanliness about a dwelling-house, that even a stranger transiently passing by, cannot help being prepossessed with a favourable opinion of those within. He passes along with the idea fixed in his mind of prosperity and happiness presiding within the walls. How different, says he, the sensation felt on viewing a contrary scene;—a house dismal and dirty, the doors and walls surrounded and bespattered with filth of all denominations, and fragments of broken dishes and dirty dairy-utensils scattered in all directions—a scene which must impress on the mind the idea of misery and mismanagement, and a contempt for those slatterns who can suffer such beastliness; for in such cases it is generally the female part of the family who has the merit or demerit of domestic appearances. And how easy a matter it is to constitute the difference; a little care and attention, says he, the whole secret. It adds greatly, he thinks, to the beauty and neatness of a dwelling-house to have a little plot of garden-ground or shrubbery before it: this not only contributes to keep every thing neat and clean in front, but is often easier managed than a garden behind. After feeling the pleasure and satisfaction of keeping this plot in good order, every weed that appears visible from the windows will be considered as a nuisance, and pulled up accordingly. So great an antipathy to weeds may thus be raised in the far-

mer's breast, that his efforts for their destruction may even be extended to the fields; and by these simple means a slovenly farmer may, he conceives, be so completely reformed, as not to suffer a weed to be seen on his farm.

It is farther noticed, that large windows add greatly to the cheerfulness of a farm-house: the sashes being placed as near the outside of the wall as possible. The reverse of this is, he says, a glaring deformity in most houses in the northern parts of the kingdom. There the windows are so small, and the sashes placed so deep in the walls, that it gives the most disagreeable gloominess to the whole building. This is said to be done with an idea of preserving the sashes from the weather—a most egregious mistake. The sashes are perhaps more liable to injury by being deep in the walls, than by being placed near the outside, for they receive full as much wet, and are not so soon dried again.

It is, he says, a common practice, and, with many, a general rule, to build the farm-house adjoining to the offices. Where the situation will not admit of a better arrangement, or in a small farm, to save a few roods of building, this may be done; but in general it is better to build the dwelling-house, and any other buildings with chimneys in them, a little way detached from the farm-offices, not only on account of the danger arising from fire, but of the disagreeableness (perhaps unwholesomeness) of living in a dung-hill, or in the midst of cattle and swine. If, says he, a farm-house, for the sake of uniformity, is to be built adjoining the farm-yard, there should be a considerable length of wall at each end of it, to unite it to the offices. But it is certainly better to make the house a little distance from the wall of the yard; and whether that distance is ten feet or fifty feet, there can be little or no difference with respect to convenience. At the same time it is by no means advisable that the farm-house should much exceed fifty or sixty yards from the offices, as there might unquestionably some inconvenience arise if beyond that distance. In the annexed plans of farm-houses, four things are particularly attended to in their construction—simplicity, uniformity, convenience, and cheapness. In delineating such buildings, therefore, there is not, he thinks, that latitude given for a display of those architectural ornaments, which, in a higher sphere of buildings, are so pleasing to the eye, and so truly beautiful when disposed by the hand of a skilful architect. Such ornaments are unnecessary in farm-buildings, and are therefore entirely omitted. At the same time a strict attention to uniformity is particularly observed; and although the windows are, in general, made something wider in proportion to their height than is permitted by the rules of architecture, in order to answer the purpose of giving as much light as possible (the chief use of windows); it is, however, hoped, that no very great or offensive deviations are made from those rules, even in that case. The accommodations are calculated to be as convenient as possible, in the family way; and, by making the ground-floors at least sixteen inches, or two steps, above the level of the ground, and taking proper care to lay those floors, a great deal of that dampness (and consequently unwholesomeness) so often complained of, will, he conceives, be prevented.

Many people, he says, prefer gable-ends, as in *fig.* 2. *pl.* XXXV. For his own part he is, however, of opinion, that hip-roofs, and the vents within the building, are greatly preferable. The hip-roof requires no more materials; and the gable-ends not only occasion more expense of building, but an unnecessary addition of weight upon the end walls. Vents built withinside the house are less liable to smoke than when in an outside wall; besides, they contribute greatly to keep the house warm, for they act as flues, and diffuse their heat, in some degree, all over the building. It must be observed, that the principal walls are all delineated of the thickness of two feet, that being considered as the best thickness for rough stone-walls. Where the stones are good, and of a proper form for building, or where bricks are used, the walls may, no doubt, be thinner; but, when too thin, the heat of the sun in summer, and the coldness of the external air in winter, have so disagreeable an effect, by penetrating through, that it is best to err on the safe side, and to make them of a good thickness. This is one of the greatest inconveniences, he observes, of brick buildings; for in general brick-walls are so thin, that these effects are most sensibly felt both in summer and winter.

By making the different apartments and other divisions and conveniences no larger than necessary, the least possible expense will, he says, be incurred. The dimensions of these should be proportioned according to the sum intended to be laid out. Very frequently, he says, a good plan is thrown aside, merely on account of the expense of putting it in execution; whereas it should be considered, that, by contracting the rooms, and the building in general, the same plan may be executed accordingly, at whatever expense may be determined on. The plans given may therefore be varied in size, till of such dimensions as will cost no more than the sum allotted for that purpose. For these reasons, estimates of buildings, in a general view, are, he conceives, really of less importance than most people imagine, there being hardly two counties in the kingdom where the same plan can be executed at the same expense. Even in the same county and in the same parish, the expense will often vary considerably, according to circumstances. The distance from materials, the quality and price of those materials, the goodness or badness of the roads, the nature of the soil to be built on, and consequently the expense of the foundations, the price of labour, the season of the year, and even the state of the weather, all tend to make a difference in the expense of building. Is is therefore hardly possible to make a correct estimate, unless the spot intended for erecting the building is known and examined; and an incorrect estimate is much better to be omitted. Some people, he remarks, will pretend to make an estimate without even inquiring into

those circumstances which must regulate the expense, knowing that when the sum they mention is expended, their employer will not stop the building on that account. It is best, therefore, to be cautious in dealing with such people, unless they will contract for the sum estimated.

In some parts of the country, it is observed, a house built on the plan and of the dimensions shown at *fig.* 1. *pl.* XXXV. may be completed for about 70*l.* or 80*l.* In other parts, it may cost 150*l.* or more; consequently it would tend only to mislead, by stating either the one or the other as an estimate of such a building. *Figs.* 3 and 4. are also on larger plans. Yet to commence a building, without knowing previously the expense it will cost, should at all events be avoided, as being almost a certain opening for imposition. The best way, therefore, to ascertain this, is to choose a plan: if the proposed building is not of that extent or importance to require the aid of an architect, employ any person conversant in those matters, whose fidelity can be relied on, to examine the ground, and to consult with different tradesmen concerning the expense at which they would undertake to execute their respective parts: a pretty correct estimate may, he says, thus be obtained. Or the plan may be laid before different intelligent tradesmen, and their estimates required, and afterwards examined into; not only as to the charge made, but the manner of executing the work—for it is not always the lowest estimate that is to be preferred. If in either case the sum should amount to more than is proposed to be laid out, the dimensions of the plan, and the manner of finishing some of the parts, may be altered, till it is found that it may be executed for about the sum proposed.

It is remarked by the author of Modern Agriculture, that, in regard to the share of expense and trouble which proprietors and tenants in general ought to be subjected to in erecting farm-houses, all leases should contain a clause, by which the proprietors become bound to be at the expense of materials and workmanship, to the extent of a stipulated sum, rather above than below two years rent. The tenants should not only undertake the carriage of materials, without making any charge for so doing, but also become bound to keep the houses in good order, and to relinquish them equal in value at the expiration of the lease, or to pay any deficiency, as the same may be determined by proper tradesmen, mutually chosen.

It has, it is said, been a common practice in some parts of Scotland (which ought to be introduced every where), to bind tenants to insure their houses from any damage by fire. This clause in leases is attended with another good consequence,—the tenants generally insuring their stock and house-furniture at the same time; so that, when any accident happens, they are saved from the ruin which otherwise must necessarily ensue.

The farmer's capital, it will readily be acknowledged, ought to be employed in stocking and improving the farm, rather than in erecting houses; therefore, it is certainly bad policy in the landlord to divert that capital from those channels in which it ought to flow freely, and without interruption. On the other hand, the circumstance of the tenant being obliged to maintain the houses in good condition during his lease, and to leave them of equal value at his removal, would induce him to pay proper attention that the houses be substantially built, and that every necessary repair be completed in proper time, and in the most effectual manner. When repairs only are necessary on the entry, they ought to be performed at the mutual expense of parties. The proprietor should advance the requisite sum for materials and workmanship, and the tenant perform all the carriages. A clause should also be introduced into the lease, by which the landlord may have a right to execute repairs, provided they are deemed requisite by proper tradesmen sent to inspect the houses, intimation thereof being made a reasonable time before to the other party. This, it is thought, would prevent that heavy load of expense which proprietors are frequently subjected to when tenants remove, and a mutual interest in the preservation of the buildings would be formed between the proprietor and tenant. The tenant, although liable to pay for frequent partial repairs, would avoid the expenditure of large sums; and, if bound to leave the houses equal in value to what they were when he entered, as he certainly ought to be, the landlord would seldom be put to the expense of large sums in the erection of new buildings.

At *fig.* 1. in the same plate, is represented the elevation, and at *fig.* 1. *pl.* XXXVI. the ground-plan, of a small farm-house, calculated for a farmer who lives with his servants. It may be divided as follows: *a*, the entry; *b*, the kitchen, having an oven at *k*, if required; *c*, a small apartment off the kitchen, in which may be a bed, or it may serve for a store-room, &c.; *d*, the farmer's private room, or parlour; *e*, dairy (or the dairy may be at *c*, if thought preferable); *f*, hen-house, or for keeping small implements, as spades, shovels, rakes, &c.; *gg*, *fig.* 2. chamber-floor, containing two bed-rooms; *h*, pigeon-house over the necessary. The dimensions are marked on this and the following plans, but may be varied at pleasure, according to circumstances.

In *pl.* XXXV. *fig.* 2. is the design for a farm-house, which, if properly executed, would have a very pretty and uncommon effect, especially if built on an eminence, and having a neat garden in front. This house is supposed to be also for a small farm, but larger than the preceding, and for a farmer and his family rather in a better style. It may be divided in the following manner: *fig.* 3. *pl.* XXXVI. the ground-plan; *a*, the principal entrance, and lobby; *b*, parlour; *cc*, clossets; *d*, store-room for meal, cheese, &c.; *e*, lumber-room for small implements; *f*, beer-cellar; *g*, pantry; *h*, dairy; *i*, staircase; *k*, kitchen; with an oven under the stairs, and a boiler on the other side of the fire-place; *l*, coals or wood, and back-entry; *m*, pig-sty, with a small opening towards the kitchen for throwing in dish-water, offals, &c.; *n*, poultry-house.

Fig. 3. *pl.* XXXV. shows the elevation, and

figs. 4 and 5. *pl.* XXXVI. two ground-plans of a farm-house, upon a larger scale than either of the two former. Plan 4. is divided as follows: *a*, principal entry; *b*, parlour; *c*, family bed-room; *d*, kitchen; *e*, dairy; *f*, pantry and cellar. The three latter are attached to the back part of the house by a continuation downwards of the same roof. By making their cielings only seven and a half or eight feet high, some small bed-rooms may be got above them, having a few steps down from the floor of the front rooms, or a few steps up from the first landing-place. At Burleigh, a seat of the earl of Winchelsea, is a very good farm-house, built, it is observed, nearly upon this plan. The back-door of the kitchen enters into a brew-house and wash-house, the fire-place and copper being behind the kitchen vent. Beyond this brew-house is a place for holding fire-wood, &c.; in the back-wall of which are openings to feed the swine at. In the kitchen is an oven; and below the grate a very good contrivance for baking occasionally, but principally used for keeping the servants' meat warm. It consists of a cast-iron plate, and door like an oven. The chamber-floor is divided into two rooms forwards, and two small ones backwards.

Plan 5. is another manner of dividing the ground-floor. *a*, the parlour; *b*, the kitchen; *c*, closet; *d*, dairy; *e*, pantry; *f*, coal-house; *g*, poultry-house; *h*, pig-sty, having an opening to the kitchen; *i*, back-entry. The chamber-floor may be divided into two very good bed-rooms, and a light closet to hold a bed also, if necessary.

Fig. 4. *pl.* XXXV. is the elevation of a farm-house, which may be made suitable to a farm of any extent, and may be divided according to either of the two following plans.

Plan *fig.* 6, *pl.* XXXVI. *a*, front entry; *b*, best parlour; *c*, common parlour; *d*, lobby and stairs; *e*, kitchen; *f*, pantry; *g*, dairy; *h*, cellar; *i*, back-entry.

Plan *fig.* 7. *a*, front-entry; *b*, parlour; *c*, kitchen; *d*, back-entry under the stairs: *e*, brew-house; *f*, cellar; *g*, pantry; *h*, dairy; *i*, door of brew-house and back-entry. The accommodations in the back part of this house are supposed to be obtained in the same manner as in plan 4. *fig.* 7. and also the bed-rooms on the chamber-floor. This mode of enlarging a house, it is observed, saves a considerable deal of expense, and does not require so high nor so weighty a roof as if the back-walls were carried up to the same height as the other walls. A variety of different elevations might be given to suit the same plans, and many different plans to suit the same elevations. Several other conveniences might also, Mr. Beatson observes, have been given; but where these are omitted, it is supposed they are detached from the house, consequently could not be here included. It is, however, presumed, that these four examples will afford sufficient *data* for the construction of farm-houses suitable to farms of any description or extent.

At *fig.* 1. *pl.* XXXVII. is represented the elevation and plan of a small farm-house and offices, arranged in a way, it is presumed, that would be very convenient for the business of the farm. *a*, *fig.* 2. the barn, with a water thrashing-mill; *b*, a straw-house, being a continuation of the barn above, for holding a quantity of straw after it is thrashed, or hay, that it may be at hand to give to the cattle in the feeding-house below. The upper part of this straw-house may consist of pillars to support the roof, with about eight feet space between them, whereby a good deal of building will be saved. In the floor should be hatches, at convenient distances, to put down the straw to the cattle below. *c*. a court for the dung-hill, with a door to it from the feeding-house, and a large entry at the other end to admit carts to take away the dung: on the outside of this should be a urine-pit, in the most convenient place, according to the form of the ground. *d*, a cow-house, with a door also to the dung-court; *e*, a calf-pen, with a rail across to keep in the calves, even though the doors are all open; *f*, a stable, with a harness-room, and place for keeping corn; *g*, a root-house, over which, or over the barn, may be a granary; *h*, shed for carts, &c.; *i*, place for keeping large implements, as ploughs, harrows, &c.; *k*, for keeping smaller implements, as spades, shovels, rakes, forks, &c.; and for laying by old iron and many other useful things that might otherwise be lost or thrown away. *l*, is a pond for washing the horses' feet: it slopes down from each extremity towards the middle at *l*, where it is deepest, that the horses may easily go in at one end, and come out at the other: it should have a rail at each end, to prevent them going in during frost, or when not wanted to go. *m* is a pump, with a trough for the horses or cattle to drink in, especially while other water is frozen, or when the water in the pond is dirty; but if it can be contrived so that the water which drives the mill may run through this pond, it will at all times be clean and wholesome.

At *n*, *fig.* 3. is the ground-plan of the dwelling-house, with dairy, pantry, and various conveniences behind for keeping swine, poultry, coals, &c. The stair to the upper chambers rises from either side to the same landing-place; from whence are a few steps up to the chamber-floor. But if any of the former plans given are preferred for the dwelling-house, they will suit the same arrangement. One material advantage of this arrangement, Mr. Beatson remarks, is, that the fodder consumed upon the farm goes progressively forward from the barn-yard through the cattle houses to the dung-hill, without the unnecessary labour generally occasioned by carrying it backwards and forwards; for it comes from the barn-yard into the barn, *a*, where it is threshed. It is then put in the straw-house at *b*, and given to the cattle immediately below; and after passing through them, it is thrown into the dung-court at *c*. A rick of straw, or hay, built behind the stable, *f*, or cow-house, *d*, or in a shed contiguous to either, with proper conveniences, will have the same progressive course to the dung-hill; for, it will be observed, the communication from these is equally easy from without or within; the rail across the calf-pen

being intended chiefly to keep in the calves, while the doors on each side are open when conveying the dung that way from the stable to the dung-hill.

At *fig.* 4. is given an elevation and plan of a farm-house and offices, with two courts or farm-yards: at *fig.* 5, the two farm-yards with their buildings:—*a*, is the barn, with a water-threshing-mill; *bb*, are sheds for holding the straw immediately after being threshed, by carrying it either way, as is most convenient for feeding or littering the cattle, or till otherwise disposed of; *c*, a stable; *d*, a cow-house or feeding-house. From both of these are back-doors to the dung-court, which is supposed to be behind. *e*, workshop, and for holding timber and implements, or wheels, &c. blocked out; *f*, house for large and small implements, with spar doors to admit air; *g*, shed for carts, &c.; *h*, poultry place, with a pond in it. The nests for the poultry, and roosting-places, are under small sheds at each end. *i*, a similar place, which may be used for keeping rabbits; and the pond may be stocked with fish: both of which, if carefully managed, will, in many places, be convenient as well as profitable. The front-wall of these two places is built only two and a half feet high, with a coping, on which is a paling six feet high. This may be made of thin deal, or slabs, set on end; which, being pointed sharp at top, will prevent the poultry flying over, and protect whatever may be kept there from being disturbed. *k*, *fig.* 6. is the ground-plan of the dwelling-house, with conveniences of different kinds annexed to it. In this arrangement, as well as in the former, the fodder goes progressively forward from the barn-yard to the dung-hill. It is observed, that a variety of other arrangements might be given, but these two examples seem sufficient to illustrate the observations made above, and to give a general idea of arranging farm-offices, so as to suit any form of ground, and any kind of farm; for it is upon a strict examination and a due consideration of these, that the most commodious plan of the offices suitable to a farm can be properly laid down. Several other conveniences mentioned in the preceding observations might also have been delineated; but the principal buildings being shown and arranged, it was thought unnecessary to crowd the plates with every little conveniency that might have been noticed; the position of any others that may be required being easily determined on after the principal ones are fixed. Sometimes a small square of sheds for cattle, it is remarked, is constructed within the court of offices. The sides of this square being parallel to those of the square of offices, at the distance of ten, fifteen, or twenty feet, according to the extent required. In this case, the cattle are generally fed from without; but the dung-hill being in the middle of the interior square, and the space altogether being in general so much confined, it is difficult to keep the cattle clean, or to preserve their dung in a proper state for manure. For these reasons, as well as for the additional expense of building and roofing that way, it is not a plan at all to be recommended. The plan containing two court-yards is very convenient, in the event of allowing young stock of different kinds to go at large during winter; as in that case they may easily be kept separate, and fed and attended with no more trouble than if together. In the one court might be kept the young horses, in the other the cattle; or in one of them might be sheds for sheep, if necessary.

Farm-*Offices*, such buildings or out-houses as are proper for farms. It is of the utmost importance to the farmer, that they should be distributed in a regular and convenient manner, as, by such a mode of distribution, vast advantage is gained in the labour and time that is required in performing the different business that is necessary in foddering, cleaning, and managing the different animals kept in them.

Farm-*Servants*, such servants as are requisite for performing the business of the farm.

It is noticed in the New Farmer's Calendar, that Old Michaelmas is the usual time for hiring farm-servants throughout the country; but he acknowledges himself entirely of Mr. Marshall's opinion, that it is one of those customs which ought by all means to be changed for a better. Michaelmas brings with it a great pressure of business of every description; and to be looking after servants at that time, or even to admit new ones entirely unacquainted with your peculiar methods and management, is extremely inconvenient. Old Christmas, as a season of more leisure, would surely, he says, be a more proper period for this affair. As to farming-servants, the best counsel he is able to give is, for an employer to receive no known thief or idler, to give the greatest possible encouragement, to overlook trifles, and to trust implicitly to no man's honesty or industry, but to put both to the severest test; so shall he have a choice of the best labourers in the country, and enjoy the profitable reputation of the best master. In a small concern, a farmer may himself superintend his whole business; but a gentleman-farmer, or the cultivator of an extensive tract, particularly if managed in the more varied style of the new husbandry, will, he says, require a bailiff, and overlookers, in proportion to the extent of the business. The bailiff of a gentleman, who cultivates a hundred acres of land for his convenience or amusement, will have leisure to work himself, which is impossible, or rather totally out of question, with one who has extensive business to superintend, since that alone, if he be industrious, will take up his whole time, early and late. In very large business, a bailiff will need occasional lookers on under him. A bailiff ought to have had some years experience of at least the common methods of husbandry and gardening, of the management of all kinds of live-stock, and of buying and selling; he should be able to keep common accounts; in short, he must be something, either from nature or habit, above the common labourer. But then he must have a *bailiff* over him; and such must be the proprietor of the business, unless he rather choose to risk the consequence. As to entrusting these upper-servants with buying and selling corn and cattle, he would

advise no person to do it, except indeed those whose situation is so elevated that such engagements might be thought inconvenient and improper; still, it is no derogation from the honour of a prince to be well informed of market-prices, and to be able, by inspection, to form a judgment of the worth of cattle. He dwells a little on this head, he says, because he has seen too much, both of the gross ignorance and iniquitous collusions of bailiffs and managers in bargaining. It is a common saying, "Oh! your master is a gentleman, he don't want to get money, but *we* must live!" Indeed, it is no wonder that gentlemen so often farm their own estates to loss, considering the sottish, ignorant, and knavish instruments which they employ under the name of bailiffs. It is recommended by some, to vest a bailiff with full power of discharging the servants and labourers; the propriety of which he is rather inclined to dispute. Invested with such a power, there is no check upon his conduct; whereas, were this particular made matter of reference to the principal, all necessary information on both sides would come out. One of the first qualifications of a bailiff is, he says, to have a mind perfectly indifferent to all prejudice in favour of the old system of husbandry; and where things are upon an extensive or improving scale, it ought to be an invariable maxim to receive no servant or labourer who will not positively agree to follow directions, in default of which, he ought instantly to be taken before a justice of the peace. He has known several instances of a combination among the ploughmen not to work without their accustomed number of horses, &c. See *Labourer* and *Servant*.

FARM-*Yard*, the area or court in which the farm-offices are situated, and which generally adjoins the farm-house; it is the place where cattle are foddered, dung prepared, and several other necessary operations belonging to the farm performed.

It is observed by the author of the Present State of Agriculture in Great Britain, that a farm or foddering-yard, on a proper construction, is known to be a necessary appendage to all well-regulated farms, and is considered by intelligent farmers as indispensable. When the farm-buildings are erected in the form of a square, the court-yard, he says, ought to be paved to the extent of nine or ten feet from the bottom of the walls all round. The earth should be excavated from the remainder, so as to form a hollow towards the centre. Then a thick coat of gravel, or, what is better, chalk, should be laid over the whole, which would answer the double purpose of keeping the place dry, and facilitate the shovelling up the rotten dung. Care should also be taken to have proper drains to carry off superfluous water, in order that the yard be kept dry. It would be very advantageous to have a pond for the reception of this superfluous water, which should be so placed as to flood any of the adjoining fields at pleasure.

In the New Farmer's Calendar, it is observed, that it would be nugatory to hold forth about aspect, straight lines, or right angles, in the formation of a farm-yard; such considerations will ever be postponed to those of local convenience: it will be sufficient to insist, that the space be ample and properly divided, the offices sufficiently numerous and commodious, and the whole sheltered in every quarter. In the arrangement of the offices, namely, the dwelling, barns, stables, cattle-houses, and sheds, the material objects ought to be such a position as may contribute to convenience and the abridgment of labour, and at the same time afford the largest possible proportion of shelter: this last, however, must obviously, he thinks, give way to the former consideration; and, as a substitute, all the vacant places or exposures may be well barricadoed with a lofty, warm, and substantial fence. Mr. Marshall's idea, of an angle of the buildings presenting to the north, by which position the two sides would afford shelter in the most material points, from the N. W. to the N. E. is, he thinks, happily conceived. Respecting the number of yards, no precise rule can, he says, be expected, any farther than to state, that, in the smallest concern, a division is necessary, and in those of greater magnitude, two main yards, with appendages for stacks and other purposes, conveniently situated, will properly describe the homestall. A barn seems the natural division of two yards, since it will serve the common purposes of both.

The following plan of a farm-yard is afterwards offered to the attention of the farmer. A circle of sufficient extent being marked out, and the area properly levelled and hollowed in the centre, the whole of the needful farm-buildings of every description, barns, granaries, mill-house, stables, ox and cow-houses, pig-styes, store-rooms, and sheds, are to be erected around, in the most convenient order in point of useful contiguity, and with reference to shelter in the coldest exposures. The area being so spacious that the buildings will not completely surround it, every vacancy is to be filled up with a good fence; with or without a lean-to and roof, as a shed. As many of these sheds as are required may be run up against any of the buildings, that none of the cattle of the fold need be abroad, or feed in the rain or snow. Divisions and sub-divisions may be made at will, with hurdles, faggots, or posts and rails, for the purpose of every requisite separation of stock. The number and position of the entrances to be regulated by local convenience, the gates being boarded to render the security complete. The stack-yard must be formed without the circle, the corn-stacks being placed within the least distance possible of the barn or threshing-machine; those of hay and straw in an equal degree of convenient proximity to the backsides of the stables and cattle-houses. It is obvious, that the back parts of the buildings will afford convenient walls for sheds or erections of any kind, should a very large stock or peculiar circumstances render it necessary to fold a part withoutside the circle; the communication, or rather the whole system, may, it is asserted, be rendered complete, by furnishing all the principal buildings with entrances for cattle, backwards, as well as in front. In the investigation of this scheme,

however, it will be easily perceived that a mere pedantic literal adherence to the figure of a circle, to which every other consideration must yield, is not so much intended, as a generally round compact inclosure; nevertheless, it seems that the nearer the figure approaches to a true circle, the less will be the waste of ground and expense in fencing. Although not absolutely necessary, it would be a point of great convenience, it is supposed, for the backside of the dwelling-house, consisting of the dairy, and other out-offices, to form a part of the fold-yard circle. The wash of every kind from the kitchen and dairy should be saved with the utmost care, and led by proper sinks and pipes into a capacious underground cistern, from whence it may be pumped into the hog-troughs, the styes being placed within a reasonable distance for the sake of that convenience. Adjoining the dairy should be found the cow-houses and fatting-houses for oxen; the pig-styes next: between the styes and the ox-stalls is a handy situation for a boiling and washing-house, in which an oven, also, or kiln, is an excellent convenience. The lofts above the different offices might, it is suggested, communicate by doors through their several partitions, with the granary, threshing-mill, and barn, affording the convenience of wheeling sacks of corn, or chaff, to every part. Room above or below must be afforded likewise for hay, potatoes, cabbages, and every other article of provision of that species. In feeding stalled oxen, to approach them at the head instead of the feet is much the best method; for which end a gang-way, sufficient to admit a large barrow, may be left between the wall and their head-boards, these being made to slide. Such is the practice of several distill-houses which feed oxen; and it has been recommended, where cattle feed at racks appending to the barn-side, to have sliding boards through which the threshers may push the straw, without having to quit the barn, in order to replenish the racks. A chaff-house should be connected with the barn; and we will suppose the opposite range, whether stables, sheds, store or cattle-houses, to have an appropriate share of those conveniences of connection already stated, that as little waste as possible may be made, of time, labour, and materials.

It is also hinted, that, in an extensive farm, where it is ever inconvenient and expensive to cart manure to the distant grounds, the great convenience of out-stalls appears very striking. It is not meant to insinuate, that there are never any out-yards upon large farms, but that they are not, in general, enough attended to, so as to render them of sufficient utility. A yard of this description, well fenced in, might, it is supposed, contain a cottage for a labourer and his family, a stable for a plough-team, with sheds for straw, cattle, and sheep: but threshing in distant barns is imprudent; and, of two evils, it would be the least to cart the straw from home, stacking or housing it at the out-stalls.

There have been different opinions about the nature of the situation, or receptacle, for the stall or yard-manure; some supposing it the best when on a *level* surface; others, when a little *raised*; while others, the numbers of which are very considerable, are, on the contrary, decidedly in favour of its being in a *hollow*: and this last, Mr. Marshall thinks, on long experience, to be the most suitable; but, says he, though it should be hollow, it does not follow, that it ought to be *deep*. Its principal use, besides holding the dung, being to brink the rain-water falling within the yard into a stagnant state, and to let it off superficially, so as to avoid any thing of ground-current from conveying away the dung, either in a body or thick fluid condition; merely suffering the more watery particles to run off into a receiver or reservoir, constructed for the purpose of preparing and preserving them for being made use of afterwards. It is supposed, that the depth of two feet on the lower side, or deepest part, may be a mean depth; the bottom of the waste-water channel being laid six or eight inches lower than the rim of the hollow or bason, the depth of water that it can contain, when free from dung, cannot be more than sixteen or eighteen inches, and as it is necessary to good farm-yard management, that as soon as the dung collected during the winter-season has been removed, that some sort of earthy materials should be deposited evenly over the bottom of the bason, for the liquid matters to operate upon, and bring into a state of manure, throwing upon them all the different substances that can be brought together in the course of the summer and autumn; by which means, from the bason being nearly filled up at these periods, the dung collected during the winter will be raised and supported out of the way of water, which is supposed by some to prevent the conversion of the different substances into manure. It is obvious, that suitable drains must be constructed from the stalls of the different animals, as well as from the pig-sties, and other buildings, where any sort of stock is fed and kept, to the hollow, or bason, in order to convey the liquid matters; the mouth of the out-let channel being well secured from being choaked up, by piling the dung up to a great height above it; a suitable well or pit being provided and kept ready for the reception of the superabundant liquid to filtrate and discharge itself into. When the farm has grass-lands lying in a suitable manner below the level of the yard, on which the overflowings of such basons may discharge themselves, every part of the dung-yard may have a shelving direction towards the receptacle. But, in other cases, it should not receive any more water than is supplied by the atmosphere; which may easily be effected by elevating the rim a few inches above the surrounding surface of the yard, which must be occasionally freed from the matters deposited upon it, by removing them into the bason. In these cases, the water falling on the surface of the yard should be conducted to a catch-pool to deposit its useful materials, or to a convenient drain: and that falling upon the buildings be discharged without passing through the bason; except there should be a greater want of liquid than solid manure.

The same writer observes, that "seeing the slow progress which yard-manure makes towards maturation, in the winter-season, in the open air; even when piled in the driest situation, owing to its being perpetually saturated with moisture, and exposed to a cool atmosphere; the plan of giving the receptacle a long-square form, and covering it with a roof, to free it entirely from rain-water, as well as to defend it from cold, he says, aptly occurs; and was some years ago recommended by the Board of Agriculture. By thus affording it an opportunity to pass into the state of fermentation, during the winter months, its digestion would be advantageously forwarded, for the use of early spring crops. But whether an advantage equal to the expense of the building, and to the extra labor of depositing and removal, would arise from this mode of treatment, remains, perhaps, he thinks, to be proved. It is by no means a fit scheme, he says, to be recommended at present, to the managers of landed estates, for the use of ordinary tenantry." It however deserves to be ascertained by actual trials.

The able and ingenious author adds, that "the first and great object, at present, is to prevent the excessive waste of yard-manure which may be said to prevail throughout the kingdom. And, after extraordinary attention bestowed on the subject, at different and distant periods of time, he is, of opinion, that piling it in a shallow bason, or dung-dish, and conducting the liquor, which overflows from this, to a reservoir or catchpool, to arrest the grosser particles which pass out of the yard, and to provide a valuable collection of liquid manure, in certain situations, or of rich mud in others, are the most practical means of attaining this object, at a moderate expense." This should, in all cases of new farm-buildings, and yards, be attended to as much as possible.

It is also, he thinks, a matter of great consequence to a farm-yard, to have only a *reservoir* for yard-liquor "even where there are no suitable lands to receive the contents; especially if it be furnished annually, or from time to time," as suggested above, "with a flooring of good mould, to absorb the sediment which the liquor will let fall, when it is thus brought into a stagnant state: embracing a dry season, when the water is entirely evaporated, to carry out the rich compost thus formed, to spread upon grass-lands, and especially on mowing ground, immediately after the crop has been carried off" from the ground. It is added, that "the utility of a receiver of this kind, whether it be formed for the purpose of irrigation, or as a mud-pool, will generally be in proportion to its size; and its cost, in a given situation, will be in like proportion. But it will, he supposes, seldom fail to pay, amply, for the expense of forming it. For if one which costs ten pounds encrease the annual produce of hay only one load, a tenant may well afford, he thinks, to pay six per cent for the use of it. On a sloping wavy surface, a pool of this sort may, he says, be formed at an inconsiderable cost, compared with its utility." It is suggested, that the shape, or "form of the reservoir matters not; provided, when it is intended for irrigation, it be furnished with a valve; in order that, when it is full, the water may be let off, in a sufficient body, to be spread evenly, and with full effect, over the ground" on which it is to produce its beneficial operation.

In *pl.* XXXVII. *fig.* 2. is represented the plan of a convenient square farm-yard, with the different necessary offices, so arranged as that the business may be carried on with the greatest expedition and economy; and at *fig.* 5. is given a plan where two farm-yards are represented with various suitable buildings and other conveniences. When the dung is carried away every season, the court-yard should, as hinted above, be covered to the depth of two or three feet with chalk, marl, scourings of roads or ditches, or any sort of rotten vegetables, as a foundation for next year's stock. If these particulars were attended to, and the dung from the stables, cow-houses, and other buildings where the live-stock is kept, regularly spread over the refuse of the straw, trodden down by the cattle, a treasure of valuable manure would, it is asserted, be amassed, which would amply repay the trouble and expense. It would be much for the interest of every farmer, that there was a pump, well, or other abundant supply of water, either within or immediately adjoining the straw-yard; and wherever this can be had, no expense should be spared in order to procure it, as few things injure live-stock more than the want of a regular supply of this very necessary article.

The square form of farm-yards has now for the most part given way to those of the circular or many-sided kinds, as being more convenient, and affording more room in a given space, as stated above. At *fig.* 1. in *pl.* XXXVIII. is shown a yard of the first sort upon an improved extensive scale, and at *fig.* 2. one of the latter kind, which has been found very convenient in actual practice.

When, says Mr. Donaldson, "farm-buildings are without order or connection with each other, as is too generally the case in many parts of the kingdom, the dung is commonly thrown on spaces of ground allotted for the purpose, opposite to the doors of the stables, cow-houses, &c. where it is allowed carelessly to remain; its more valuable particles, in the mean while, being exhaled by the influence of the weather, till the return of the season, when it is usually laid on the lands. If the houses happen to be situated on an eminence, the dung lying in small quantities is drained of all its moisture. If, on the other hand, they are placed in a hollow, the dung is for the most part allowed to remain soaked in water. In either case, its quality must be greatly impaired, and its usefulness in promoting vegetation much less, than when, by proper attention, all the essence is retained. The advantages resulting from well-constructed farm or foddering-yards are therefore, he conceives, various and important. By means of them, the quantity of dung is much increased, and the quality rendered superior: for these reasons, he is of opinion, that the advantages of possessing proper accommodation for the cattle

on the farm are more than sufficient to counterbalance the expense incurred in erecting them.' He feels himself warranted, he says, to state this opinion, not merely because it is his own, but because it is considered as well founded by many intelligent farmers in both kingdoms with whom he has conversed on the subject. The difference must indeed be obvious to every intelligent reader, who is at all acquainted with these matters. Where proper houses and other accommodations are erected, the dung is collected into one mass, the various sorts carefully mixed together, and the superfluous water carried off by proper drains; by which means it retains its properties, and must consequently become useful, and its effects conspicuous, when applied for the purpose of invigorating the soil. Whereas, when the dung is allowed to remain in small, detached, loose heaps, the most valuable parts are either drained off or evaporated; so that what remains is comparatively of little value. Although it will be readily admitted, that an active and an industrious farmer, who labours under the inconvenience of having too few farm-offices, and those improperly situated, may, by his superior attention, lay up as great a store of dung, of a good quality, as his less assiduous neighbour, who is better accommodated as to houses; yet, whoever makes this the subject of general investigation, will find reason to be satisfied, that on all occasions where the proprietors, by liberal arrangements with their tenants, afford them the requisite accommodation for their horses and cattle, there the farm-yard dung is in general in greater abundance, and of a richer quality."

Farm-yard *Dung*, the dung or compost which is formed and collected in the farm-yard, and which is generally composed of the dung of horses, cattle, and hogs, with urine, straw, and some incidental additions; and is both the most common and the most useful manure made use of at present. See *Dung* and *Yard-Dung*.

From the above description, Mr. Donaldson observes, every ordinary dung-hill on a farm may be denominated a compost, or compound dunghill. These, generally so called, are however made up of other materials. See *Compost*, *Compost Dung-hill*, and *Yard-Dung*. For the means of increasing this kind of manure, see *Farm-Yard* and *Farm-Yard Management*.

Farm-yard *Management*, that sort of management which relates to the business and operations of the farm-yard. In order to procure as much manure as possible, the farm-yard should, as shown above, constantly be kept covered with some earthy material, on which the dung and urine of the cattle may act, and with which they may be combined, and thus increase the quantity of manure heap. "Where there is a pit or reservoir for the reception of the urine and other liquid matters from the yard, it may be so placed, it is said, in the Calendar quoted above, as to serve two yards, and may be bottomed with rammed clay, and its sides plastered with some composition which will make it retentive. Into it may be shot as much ditch-earth as it will properly hold, without causing an overflow; and, instead of pumping the liquor out, in the end, as has been recommended, the author has generally shot in earth sufficient to absorb it, afterwards carting the whole away to the compost-hill, which he believes the easier method of the two. Upon the bottom, in the yard, the layer of manure-earth is to be spread to the thickness of a foot, if possible, throughout the whole area, the quantity in the centre, or drain, being increased two or three-fold, as having the greater part of the moisture to imbibe. The whole must be kept sufficiently littered, that the cattle may not poach in the earth with their feet. The above, or some method of similar effect, it is observed, for the preservation of articles so precious to the farmer as the dung and urine of his cattle, one would suppose so simple and obvious, that common sense could never miss it. How strange then, says the author, is it, that we see such beneficial measures generally neglected, and that by men who have it in their power to compass them, and who pretend to be sensible of the value of manure? How many hundreds of farm-yards are there, says he, either mere bogs, or with bottoms which absorb and devour the most valuable part of the manure, or with a descent towards a pond, a road, or a ditch, where it runs off, to be in part or totally dissipated and lost? But what is still more singularly absurd is, he says, that a pond or drain shall fortunately stop the grosser parts of this waste, and yet it shall be suffered to accumulate for years unobserved and untouched!"

In order to promote still more the purpose mentioned above, "from every stable or cattle-house a drain, it is observed, will be necessary, in order to conduct the urine to the proper receptacle; not a mere common gutter, in which the liquid sinks or stagnates, keeping a constant puddle at the heels of the animals; there ought to be a grating, or sink-plate, to every two stalls at least, which, with the drain itself, should always be kept free and pervious. The entrance to the chief cattle-house is usually over a pavement of convenient width. The dung from the different houses must, both for convenience and preservation sake, be stowed near at hand; for, should it be wheeled into the area, it would be trodden to waste, that is to say, either bound down too hard, or too much scattered, instead of which it may be at once placed in a state proper for fermentation and putrefaction. Either slight pits may be made opposite to the stable-doors, and bottomed with marl or earth, or the dung may be made up in clamps or hills; in both which cases, the nice and scientific cultivator may, if he please, cover with straw or stubble, in order to prevent exhalation, and to promote the putrefactive process. The heaps growing to an inconvenient bulk, an auxiliary dung-hill must be pitched in the nearest situation; thus in a certain, perhaps sufficient, degree, with attention and a little ingenious contrivance, the dung may be preserved from exposure to the external air. In case of its too great aridity, or drought, in the hot season, and with the view of reproducing fermentation, no method is better,

he thinks, than to stir into the heap mud and weeds, slop of any kind, or foul water from ponds, ditches, and other similar places."

It has been the subject of dispute, the same writer observes, whether or not it be preferable, in point of interest, to keep cattle enough to consume all the straw as meat, without any being allowed for bedding: "the affirmative, he thinks, not improbable; but it is a length in cattle-feeding to which few will be disposed to proceed. But to go upon the supposition of foddering abroad, nothing can be more plain than the benefit derived to cattle from warm littering and shelter; and it is equally obvious, that young and growing stock thrive much better in the range of a yard than when confined in a stall, being also much more agreeable to their natural liking. This idea extends to store-pigs, which are almost indispensable in a yard, as gleaners of what would be waste to every other description of animals. Some are for confining all cattle to the house throughout the winter, and even recommend the expense of entirely covering in the yard with a roof of deal-boards; a greater premium, in his opinion, for the perfection of dung, than such perfection, if attained, would ever repay. In case of a very large stock, it would be to incur no slight risk of contagion. It would be to run into the extreme of the continental practice, where they exceedingly injure the health of their cattle, by too close housing, stifling heat, and hot watery slops. Theirs, and our common system, form, he thinks, two extremes. He has long also been decidedly of opinion, that sheep are equally entitled to the benefit of the home-fold with any other description of stock, and that they will repay it in an equal proportion; they must, however, be folded apart from the other cattle." Great care and attention is requisite in the management of every kind of stock in the farm-yard, as well as in respect to the proper foddering of them and the keeping of them clean.

The present mode of managing farm-yard dung, previous to its being laid on the land, is, Mr. Donaldson says, "in almost every part of the kingdom, where regular farm-buildings have not been erected, extremely negligent and improper, and such as calls loudly for reform. This will appear more especially necessary, he thinks, when we reflect on the small number of farms that are properly accommodated with farm-offices, compared with those that are deprived of necessary accommodations in this respect. We must then perceive, that the evil, in regard to the mismanagement of farm-yard dung in Great Britain, is as extensive as it is serious."

FARMER, a person whose business or employment is the cultivation of land, the breeding, rearing, and feeding, of different sorts of live-stock, and the management of the various products which are afforded by them: hence those engaged in this way may be further distinguished into arable, grazing, dairy, hay, and other kinds of farmers, according to the modes in which their farms are cultivated or employed.

According to the author of Modern Agriculture, "the farmers of Great Britain may be arranged in the following classes:—1. The king: 2. The great proprietors and country gentlemen: 3. Yeomen and farmers, properly so called: 4. Possessors of small farms: 5. Cottagers, including different descriptions of people, who cultivate small farms, and a few acres adjoining to towns and villages; and, 6. What he terms the unproductive class of husbandmen."

In respect to the first, he thinks, "it will not be denied that the governments of modern Europe have hitherto encouraged the industry of the towns, in preference to that of the country; and in some measure depressed agriculture, in order to advance manufacturing and commercial industry. While, on the other hand, the government of the immense territory of China encourages agriculture more than all the other arts; insomuch that the condition of a farm-labourer in that country is said to be as superior to that of an artificer, as with us it is inferior. It is not difficult, he says, to trace these different systems of policy to the same source, however apparently inconsistent they are in themselves. The increase of commerce and manufactures in the different kingdoms of Europe has always been attended with an increase of revenue to the state; and which, in consequence of its being brought more speedily and with less expense into the Exchequer than that arising from agriculture, becomes thereby more advantageous; while the sovereigns of China derive the greatest part, if not the whole, of their revenue from the produce of the soil. From these opposite systems of political œconomy, another might, he thinks, be established infinitely better calculated to promote the interests of the nation, by affording the means of supporting a more numerous population than is possible to be done by adhering to either of the former. Were agriculture, manufactures, and commerce, alike encouraged, they would all prosper in an equal degree; and though the revenues arising from the former might not be so well calculated to answer any sudden exigence, yet experience has proved that, in these kingdoms, they form the most sure and permanent resources of the state, as is evident from the land and malt taxes, excise on ale, beer, British spirits, cider, perry, leather, candles, and many other articles."

"If this proposition, says he, is well founded (and it is presumed it will not be controverted), it must give the most sincere satisfaction to every lover of his country to see that the sovereign of these great kingdoms, which have risen so high in fame among nations for the extent of their manufactures and commerce, has, like another Cato, turned his attention to the cultivation and improvement of his native soil, and thereby done more for the encouragement of agriculture than could probably have been effected by any other means. The example which his majesty thus holds out for the imitation of the higher classes of his subjects, cannot, he thinks, fail to be attended with consequences highly beneficial, as has been eminently testified by the meritorious exertions of his grace the duke of Bedford, and many others; while the attention of the other branches of the le-

gislature will be naturally, he thinks, turned to the formation of such laws and regulations in favour of those who practise this most useful art, as will in all probability tend in a very great degree to the further improvement of the country."

It is observed, that, on his majesty's farm, and under his personal attention, farm-houses have been built, swamps and morasses drained, plantations formed, and every means adopted that could contribute to improve the soil, or embellish the landscape. In carrying on these works, liberal expenditure has, he says, been combined with minute savings, which is indispensably necessary in all the operations of husbandry; either where the object is profit, or, as in this case, a desire to promote the public good, by endeavouring to create a spirit in others for undertaking similar improvements.

In speaking of the second class, he remarks, that "a considerable portion of the cultivated lands in Britain is possessed by the great proprietors, and such as generally reside on their estates, who may therefore very properly be denominated country-gentlemen. Exclusive of their domains or lands around their manor-houses, these proprietors commonly, he says, hold farms, which are kept under regular modes of cultivation. Many of these characters merit high commendation for their steady and unwearied attention to that great source of national wealth, the introduction of better systems of husbandry: while others have gone farther, and not only endeavoured, both by precept and example, to induce their tenants to adopt such systems as they from experience had found beneficial, but also granted leases of such duration, and on terms so liberal, as induced men possessing knowledge, enterprise, and capital, to apply them to the art of husbandry. It is to be regretted, however, says he, that this cannot be said of all the great proprietors and country gentlemen of this island. Many there are who, with a cool indifference respecting either the improvement of the country or the situation of their tenants, seem to think the chief business of a landlord ought to be an unremitting attention to the extension of his rent-roll, without ever duly considering, that, if additional rents are demanded, means should be furnished by the introduction of better systems of husbandry, improved breeds of stock, and the expenditure of money in the improvement of the property, by which tenants may be enabled to discharge such farther obligations. But from the spirit of improvement, which has of late evinced itself so conspicuously, it may be hoped, that in a little time no instance of this kind will be found amongst this highly respectable class of farmers."

In regard to the third class, or the yeomen and farmers properly so denominated, they may, he says, be considered the strength of the state. The yeoman and the farmer here alluded to, he observes, differ only in one particular; "the lands which the former cultivates are either in part or in whole his own property, while the latter rents his farm from another. In regard to industry, perseverance, and attention to business, there is no difference. Happy in their situation, removed on the one hand from the vanities and superfluities of high life, and, on the other, by their honest industry from the fear of poverty, the improvement of their farms constituting their chief study and delight, they spend their days in independence, enjoying health, and all the rational comforts of life. It is probable, he thinks, that near three-fourths of these kingdoms are possessed by people of this description. Fortunate, says he, it is for Britain, that this is the case; for, although many of the proprietors are entitled to much praise for introducing improvements into various parts of the country, it is to this class that the nation is indebted for these improvements having become so general."

It is remarked, concerning the fourth class, that "in all the best cultivated parts of Great Britain, as well as where improvements have not become general, there are many small farms. These, though not as yet in every case managed in such a manner as to produce the greatest crops which the soil is capable of yielding, are, however, much better cultivated than they were thirty or forty years ago; and the spirit for improvements among tenants of this description appears to be more general than at any former period;—although, from the want of capital, and the little attention generally paid to them by their landlords, added to their own attachment to antient prejudices, they are yet very far from having attained that degree of usefulness, in an agricultural view, to which, by adopting proper means, they may be advanced. The possessors of small farms are however, he says, very useful and valuable members of the community; honest, peaceable, and industrious, they breed up their children in the same principles, and to these are the manufacturers of our island most indebted for a never-failing supply of virtuous and useful artificers."

The fifth class, or cottagers, are those who either reside in the neighbourhood of large farms adjoining to moors or commons, or in small hamlets. They generally possess a few acres of tillage-lands, from the cultivation of which, together with what they receive for labour performed to the farmers, or from carrying on the occupations to which they had been bred, as weavers, tailors, shoemakers, blacksmiths, thatchers, &c. they are enabled to maintain their families, and to be of great service in the business of cultivation. Being for the most part industrious, and inured to labour, they bring up their children not only without becoming burdens on the public, but in such a manner as to render them extremely useful as members of society. These hamlets and cottages are also nurseries whence the British farmer draws his constant supply of labourers.

Those who cultivate small farms adjoining to towns or villages fall, he says, to be described under two characters:—"The first are such as reside in towns, and are engaged in commerce and manufactures; but who, for their amusement, or the convenience of their families, possess small farms in the neigh-

tain degree of fermentation. Starch is insoluble in cold water; but in hot water it forms a transparent glue: hence the necessity of employing cold water in separating it from the vegeto-animal part. When distilled in a retort, it yields an acid phlegm; and its coal affords, like other vegetables, a fixed alkaline salt. As starch forms the greatest part of the farina, it is probably the principal nutritive constituent in bread. The mucous, or rather the mucoso-saccharine, matter is only in a very small quantity in bread. On distillation it is found to exhibit the phænomena of sugar. The use of this matter seems to be that of producing the vinous fermentation; and, it may be observed, that the preparation of good bread probably depends on a proper proportion of the three different parts that have been shown; the vinous fermentation being promoted by the mucoso-saccharine part, the acetous by the starch, and the putrid by the gluten vegeto-animale; and that, from different states or degrees of these several stages of fermentation, the qualities of good bread are probably derived in a great measure.

FARRIER, a person who forges horses' shoes, and fixes them on the animals. As the errors committed by ignorance in this art were the cause of many diseases in the feet of horses, it naturally followed that they were resorted to for the cure of them. Hence, the whole of the diseases of these animals came ultimately to be treated by farriers, whose blunders have at last awakened the community to a sense of the evils which these useful animals have been exposed to; and, says Mr. Boardman, the term *farrier* will henceforth be exclusively applied to the *mechanic* who fashions and fixes the horse's shoe, under the direction of the veterinary surgeon. In the farrier, too, a degree of sagacity and discrimination is, he says, necessary in the application of the new principles of his art. See *Shoeing*.

Farrier's *Pouch*, in *horsemanship*, a leathern bag, used for carrying nippers, shoes, nails, and all requisites proper for new-shoeing a horse.

FARTHING-*Dale*, the fourth part of an acre of land, now generally called a rood. It is sometimes written *Farding-dale*.

FAT, provincially applied to cattle and sheep.

Fat, the oily unctuous part of the blood, deposited in the cells of the membrana adiposa, from the innumerable little vessels which are spread amongst them. The fat is to be found immediately under the skin in almost all the parts of the animal body. In some animals the vesicles of the membrana adiposa are so full, that the fat is many inches thick; and in others they are almost flat, containing little or no fat. There are two sorts of fat; one white, or rather yellow, soft, and lax, which is easily melted, called *pinguedo*; another white, firm, and brittle, which is not so easily melted, called *sevum*, suet, or tallow. Some reckon the marrow of the bones for a third sort of fat. Various hypotheses have been formed on the subject, but they are far from satisfactory. It is evident, however, that a quiet disposition, and tendency to sleep, has much effect in promoting this state. See *Stall-feeding* and *Grazing*.

Fat-*Hen*, a provincial word applied to the weed called goosefoot.

FATHOM, a long-measure containing six feet.

FATTENING *of Cattle*, the art of rendering them fit for the butcher: it is effected in different ways, and by different substances, besides grass and hay, as oats, different sorts of roots, and oil-cake. There is also more attention requisite in this kind of management than is generally supposed. Great care should be taken that the houses for this purpose be kept warm, dry, and convenient. See *Cattle* and *Stall-feeding*.

FAUD, a provincial word used to signify a truss of short-straw, containing as much as the arms can fold.

FAUGH, a provincial term signifying a fallow, or ground repeatedly tilled without an intervening crop. It is sometimes written *Fauf*.

FEAL, a provincial word signifying the sward or turf cut up from it. This practice is highly prejudicial, and ought to be laid aside.

Feal-*Dike*, an earthy fence made of feal.

Feal-*Manure*, that sort of manure which is procured from the rotting of turf, sward, or feal.

FEABES, a term sometimes employed to signify gooseberries. It is sometimes written *Feaberries*.

FEBRIFUGE, in *farriery*, such medicines as have the power of curing fevers. See *Fever*.

FEBRUARY, the second month of the year, which is usually subject to much rain or snow; it is a principal seed-month for what is commonly called lent corn:—such as the different kind of oats, barley, peas, beans, tares, vetches, and saintfoin, which may be sown at this season. See *these heads*.

Such fallows as were prepared in the autumn, with a view to the more early spring crops, should be stirred as soon in the present month as the condition of the land will admit, in order that the seed may be put in early, as well as to gain time by dispatching such business; but it should be an invariable rule with the farmer never to meddle with land while it is in a soft, adhesive, mortary state, though the sowing may be delayed or even wholly prevented, as there can be little prospect of success in putting crops in under such circumstances.

It is observed by the author of the New Farmer's Calendar, that the first opportunity should be embraced of stirring those lands which are intended for barley, carrots, cabbages, or any of the spring crops. Towards the end of this month a seed-bed may be made for cabbages, and even the seed got in, should the season be favourable. The bed should be rich, and may be harrowed fine, or prepared by hand, according to its extent. Three or four rods of ground will produce plants enough for a single acre; and about a quarter of a pound of seed, or somewhat more, will be sufficient. The bed, of course, must be kept perfectly clean from weeds.

The cabbage-seed thus sown on a properly prepared piece of ground, as a nursery-bed, where it is very

rich and fine, should be properly fenced in. The plants should also be kept well thinned out, in order that they may be healthy and strong. It is necessary, some say, to sow it in the proportion of three ounces to a perch of ground. On a large scale, the seed may be drilled at nine inches, to have the plants better kept clean. It is also useful to sow soot in the proportion of about a peck to the rod, over the new-sown seeds.

About the end of the month the seed of the cabbage-turnip, and also of the turnip-rooted cabbage, may be sown, for the purpose of raising plants, on the same sort of preparation as above.

The land designed for these sorts of plants should now likewise have a stirring, so as to reverse the ridges, but by no means turning it flat. A good proportion of land under this sort of crop is highly useful for late cattle and sheep-feed after turnips are done, where the soil is proper for them.

Where north-east winds prevail during this month, the process of paring and burning may go on with advantage, as they are highly drying and suitable for the purpose.

In dry weather, where the land is in a suitable state, dung should be carried out and spread before the plough; and on the drier kinds of meadow and pasture-ground, it is also the principal month for that purpose.

Coal-ashes, soot, wood-ashes, lime, malt-dust, and a variety of other similar manures, may be sown, or spread over the grass-lands, previous trials being made on a small scale to determine their advantages, as without this precaution much expense may often be incurred without any benefit. Over the green wheats, similar sorts of manures may also now be sown, such as soot, ashes, malt-dust, pigeon, poultry, and rabbit-dungs, and others collected from large towns; trials of their utility being made before as above. Soot, malt-dust, and animal matters, mostly answer on every sort of soil. The marl-cart may likewise be kept constantly at work during the whole of this month, when the weather will permit.

The practice of irrigating and floating meadow or other lands should likewise proceed during this season, but with less freedom towards the latter end of the month, in order to encourage the vegetation of the grass, which often rises to a good bite for ewes and lambs. Attention to the roots, as the food of cattle, should also be had at this season; such as to potatoes, parsnips, &c.

The cropping of the trees of the pollard kinds should be finished at this season. The top wood is converted to the tenant's fuel: the proprietors should of course see that no young trees are converted to pollards.

It is now a very proper time for planting trees and quick-sets for hedges, and also to plash them; to set willows, poplars, osiers, and other aquatic plants; and to lop trees, or cut and clear away the wood of coppices.

The willows, and other aquatic plants, may be set in the boggy wet places, or hedge-rows. The readiest method is by putting in truncheons or cuttings of this sort of wood, as they readily grow.

The osiers may likewise be put in in plantations or raised beds, where the soil is proper for them. See *Willow* and *Osier*.

By these sorts of quick-growing woods, much hurdle-stuff may be supplied for the farmer's use.

Mustard-seed, and hemp-seed, may be sown, if the weather prove mild: feed swans, if necessary, and make their nests so that the floods cannot reach them.

It is noticed in the Calendar mentioned above, that the borders of arable fields are too much suffered to remain in a state of neglect, uneven and irregular, overrun with weeds, brambles, underwood, and all kinds of useless rubbish, when they might, at little or no expense, and a trifling yearly attention, be rendered at this season both very seemly and ornamental, and very productive of good herbage. The latter consideration ought not to be slighted upon a farm consisting chiefly of arable land; nor need the farmer, in such case, be afraid of extending his borders. Where wood is scarce, the clearing of old borders pays well. Cut up all the wood for faggotting, and grub up the roots for the stack. Shave the brambles close, which prevent walking near the hedge or ditch, and make the foot-path on that side. Cast your ditch deep and well, throwing up the earth upon that which is obtained in levelling the border, all which will be a valuable acquisition to your compost dung-hill, and may remain in the field, the dung being carted to it. The borders ought to be sown with good grasses; and if their spontaneous growth should be rank and sour, culture, close pasturing, and the scythe, will soon produce finer and sweeter herbage.

There is frequently, it is said, a great overflow of fat-cattle upon the markets, in the autumn, and about Christmas; and therefore those stalled or home-fed oxen which can be kept may find an advantageous market in the course of this month. January and February are also good seasons for the sale of pig-stock of all descriptions, fat or lean.

Constant attention, it is observed, must be paid throughout the winter-season to the state of the water-furrows in the wheat-grounds, that they be always kept free and open with the spade, the earth being liable to fail in from various accidents. Let all new-ploughed lands be regularly water-furrowed, as soon as the plough has finished, which is necessary as well at this season as in autumn, more especially on stiff or retentive soils.

Care must be taken of such ewes as are about to lamb at this season, by providing for them the best and most sheltered pastures.

It is highly useful, when the ewes begin to lamb, to keep them in littered folds during the nights, the shepherd having a cot or hut on the side of it, to be ready to assist them, or the lambs, where it may be necessary. In some sheep districts, these huts are made of wood, on wheels, so as to be conveyed from place to place with the flock; but fixed ones in proportion to the extent of the farm are probably more advisable. On inclosed farms, the ewes, as they drop their lambs, may be turned upon the rouens or

preserved after-grass, which is of vast advantage in supporting them at this season.

The making of composts may likewise at this period be attended to with advantage. See *Compost.*

Moles should also be taken at this time, when they are troublesome.

FEED, the quantity of oats or other kind of grain given to a horse or other animal at one time. It also signifies to fatten animals, as cattle or sheep.

FEEDERS, fattening cattle.

FEEDING, the act of fattening domestic animals of any kind.

Feeding *of Cattle.* See *Cattle and Stall-feeding.*

Feeding-*Houses*, such constructions or buildings as are appropriated to the fattening of cattle in. They should be warm, and at the same time capable of being well aired or ventilated.

Feeding-*Piece*, a term applied to grazing ground.

Feeding or *Mowing*, the practices adopted with new laid down grass-lands, the advantages of which have been disputed by different farmers. See *Laying down to Grass*, and *Pasture.*

FEET, the bases or parts which support animals, and upon which they move. See *Foot.*

FEG, a word provincially applied to tough dead grass.

FELL, the skin or hide of an animal.

FELLING *of Timber*, the act of cutting down trees for the purpose of timber.

When any sort of tree is intended to be cut down for timber, the first thing to be taken care of is a skilful disbranching, or lopping off, such limbs as may endanger it in its fall, trees being frequently spoiled for want of a previous care of this kind; and therefore, in very large arms, chop a nick under them close to the hole, and then by meeting it with downright strokes, it will be severed without splitting. Take care also to cut the trees as near the ground as possible, unless you design to grub them up, the doing of which will be of advantage both in the timber and to the wood; for timber is never so much valued, if it be known to grow out of old stocks. M. de Buffon has observed, that the trees intended to be felled for service should first be stripped of their bark, and then suffered to stand and die upon the spot, before they are cut down. For by this means the sappy part, or blea of the tree, becomes as hard and firm as the heart; and the real strength and density of the wood has been proved, by many experiments, to be greatly increased by it. See *Woods* and *Timber.*

FELLY, a provincial word signifying to break up a fallow. It also signifies a part of a wheel.

FELON, in *farriery*, a term sometimes made use of to signify a sort of inflammation in animals, similar to that of whitlow in the human subject.

FEN, a term generally applied to such boggy or marshy lands as are very soft, and disposed to the production of coarse vegetables, from the stagnation and retention of water.

There are vast tracts of this sort of lands in different districts, but particularly in Lincolnshire, Cambridgeshire, and other adjoining counties, which, by proper inclosing, draining, pairing and burning, and the growth of suitable crops, might be rendered highly valuable; but which, at present, afford little, except reeds, sedge, or rushes and coarse grasses. The following is the estimate of Mr. Parkinson, of the probable improvement that might be made by these means of the east and west fens in the county of Lincoln, as stated in the Agricultural Report of that district:

Present Value. *Dr.*	£.	s.	d.	*Improved Value.* *Cr.*	A.	R.	P.	Value per ac.	£. s. d.	Rent. £.	s.	d.
To the present value of all the common-rights in the east and west fens	4,173	5	0	By the west fen - -	16,924	2	6	20		16,924	10	9
				By the east fen - - -	12,424	3	39	15		9,318	14	11
				Total improved value, Cr. -	29,349	2	5			26,343	5	8
				Deduct the present value, Dr. - - -						4,173	5	0
				Net improvement - - - - - -						22,070	0	8
				By the Wildmore fen -	10,661	2	25	20	10,661 13 1½			
				Deduct Dr. as opposite				—	1,515 13 1			
To the present value of the common-rights in the Wildmore fen -	1,515	13	1	Net improvement						9,146	0	0
				The whole improvement of the East, West, and Wildmore fens - - - - - - -						31,216	0	8

On this it is observed by the author of the Survey, that the "calculation is taken from the average of the common-rights in two different parishes, viz. Lushby, and Revesby, the one being detached a great distance from the commons, the other much nearer, which makes a data for the whole of the towns; and if those two parishes' common-rights produce a given sum, and their two shares of land-tax amounts to, Lushby, 40*l.*; Revesby, 237*l*; all the parishes which have right upon the fens amounting to 3975*l.* 15*s.* produce the above sum of 4173. 5*s.* per year, which gives the present value of the common-rights upon these fens, from 29,349 acres, at about 2*s.* 10*d.* per acre; when, by the improvement from an inclosure, the said 29,349 acres produce 26,243*l.* per year, averages about 17*s.* 11*d.* per acre, which is the moderate average value; although there are certain lands taken in to defray the expense of draining the West fen, let by auction for 34*s.* per acre; in the average about 1000 acres in farms."

It is added, that "the principal reason why those fens are so unprofitable in their present state, arises from the disorder in stocking; because human nature being in their various capacities anxious of property, some through avarice, or a wish to get rich at once, stock so largely as to injure themselves, and oppress the common; others, in the line of jobbing, put in great quantities of stock to sell again, which are altogether injurious to the fair commoner, who only stocks with what his farm produces. Because, suppose one man stocked a pasture of 29,349 acres, he would consider the different sorts of cattle to be depastured thereon, for each to thrive and yield their proportionable share of profit; but if 3000 men stock, they have different views of supposed interest; some increase their breed of sheep, beasts, horses, geese, &c. There are instances of a cottager renting 5*l.* per year, having 1500 or 2000 breeding geese, which must injure his neighbour of 5*l.* per year, who has got only a few sheep or a cow."

It is further stated, that "as it appears, if these commons were inclosed, they would produce a yearly rent of 26,243*l.* 5*s.* 8*d.*—All plough-farms there being estimated to produce three years rent, 78,729*l.* 17*s.* which increase of property would, it is said, employ more poor, maintain more farmers, increase trade, and produce great quantities of grain, which now costs English money to import from foreign nations."

It is added, that "the principal proprietors have long had this improvement in agitation, particularly since so many inferior neighbouring commons have been embanked and inclosed to such great advantage; but this being more extensive, and having large mortmain estates intermixed, and also a difference in the rights between the Soke of Bolingbroke and Holland Town, have hitherto protracted the proceeding."

The writer also remarks, that "along the sea-coast of the hundred of Skirbeck, there are about 1000 acres of sea-marsh beyond the bank, covered by spring tides, capable of being taken in to very great profit; but not done, waiting for an act to inclose the fens, in order then to take in the marshes." And it is, he says, Mr. Linton's opinion, "that these fens will never turn to any personal or public benefit, but by inclosure; for though certain profits are made, yet such losses happen now and then as cut very deep indeed into the benefit."

This statement of the inutility of lands of the fen kind in their present state, and the vast advantages they are capable of, by proper means, should arouse the attention of the proprietors to attempt their improvement in all situations where they exist. See *Fenny Land.*

Fen, the name of a pernicious distemper to which hops are subject. It consists of a quick-growing mould, or moss, which spreads itself with much rapidity, and occasions great injury in the hop-grounds. See *Hops.*

FENCE, any kind of erection made for the purpose of inclosing ground; as a hedge, ditch, bank, wall, railing, pailing, &c.

Fences may be considered as of two kinds—*simple* or *compound.* Of the first sort are all such as are sufficient of themselves for the purposes of inclosure, without the assistance of another kind; as simple ditches, hedges, pailings, railings, dikes, walls, &c: 2dly, such as require the assistance of another kind, either to guard and protect, or render them secure; as hedge and ditches or banks; hedge ditches and pailings, or railings; double hedges; hedge and wall; hedge ditch and wall; hedge ditch and trees; hedge, or hedge-wall and belt of planting, &c.

Fences are not only useful as affording shelter in exposed situations, but as barriers for confining different sorts of live-stock, and defending various sorts of crops from their depredations. In the early state of husbandry they were little known or wanted, except in particular places, as near the houses or yards. And uninclosed lands are still in the same state. It is remarked, by Mr. Marshall, that "in some of the more mountainous and recluse parts of the island, which are in the state of appropriation, fences, unless to divide distinct properties, are still wanting; there domestic animals are still tended, to prevent their trespassing on corn and other crops; not only children and youth, but women, and sometimes men, are seen lying about on pasture-grounds as individuals of the herds." In this country, however, "unless where the feudal arrangement is, he says, still suffered to remain, or where appropriated mountains, and high-lands are occupied as sheep-walks, fences are universally prevalent, excepting, further, the chalk-hills in the more southern districts of the kingdom, a particular style of country, where large tracts of appropriated lands in general situations, and in a state of mixed cultivation, are still found entirely open; but these hills are peculiarly adapted to sheep-husbandry, and the higher, bleaker, and less fertile parts of them have ever been occupied as perennial sheep-walks; hence, large flocks of sheep are kept under the care

of shepherds, who tend them during the day, and fold them at night; thus preserving the crops from damage. But whether the chalk-hill practice is, or is not, accurately right, it is, he says, evident that wherever horses, cattle, or small flocks of unshepherded sheep are the pasturing stock, fences are essential to modern English husbandry." The proper season for performing this sort of work is from November to the latter end of January, as to begin sooner, or protract the business later, is highly injurious to the hedge-plants. It is likewise advisable, that in all cases they should be got into proper order during the three first years of a lease; afterwards dividing the whole length into twelve parts, that one may be repaired annually, and the whole be thus kept in proper condition. It is of vast advantage for the farmer to give a proper attention to his fences, as without they are good, he must be in constant danger of having much injury done to his crops by cattle, and of course of sustaining great loss. Besides, nothing has so bad an appearance on a farm as broken and tattered fences.

Having laid down these distinctions and directions in regard to fences, we shall proceed to give details of each, and point out their nature and advantages, as well as the best methods of constructing, preserving, and rendering them durable.

Ditch-Fences.—In speaking of this sort of simple fences in general, Mr. Somerville observes, in a paper in the second volume of Communications to the Board of Agriculture, that "though ditches now form a part of that class of fences which we term *compound*, yet, in their simple and original state, they were considered rather in the light of open drains; and, in place of being looked upon as a fence, their greatest benefit was supposed to arise from their receiving or carrying off the superfluous moisture from the inclosed field. In a variety of instances, he says, ditches are made for this purpose only, where there is no intention whatever to inclose the field. They are, however, sometimes meant as a fence, but, in such cases, they are made very deep and wide; and the earth taken out of them is sometimes formed into a bank, the height of which, when added to the depth of the ditch, forms a tolerable barrier. In general, however, the greatest value of the ditch is met with when it is used in conjunction with other fences, as will be seen under the second class, or *compound* fences. The form of ditches, says he, is various; some of them being of a uniform width both at top and bottom; others are wide above, and have a gradual slope downwards; a third kind have one side sloping and the other perpendicular. For whatever purpose the ditch is meant, he, however, thinks the sloping form is by much the best; as it not only costs less money in the digging, but is at the same time much more durable, and has a neater appearance. Where open ditches are indispensably necessary for the drainage of the field, the sloping ditch is preferable to every other; as the sides are not liable to tumble in or be undermined, or excavated by the current of the water, when properly executed. The slope should be considerable; perhaps not less than three times the width at top than it is at bottom." The advantages of this construction will, however, be more fully explained in speaking of hedge and ditch fences.

It is remarked by the same writer, that "the open ditch, with a wall or perpendicular sides, is liable to much objection, both in its simple and compound state: that in its simple state the sides are perpetually tumbling in, especially after frosts or heavy rains; and if the field round which these ditches are made has any considerable declivity, the bottom is undermined, and large masses tumble down, bringing the hedge along with them. These circumstances are of themselves, he thinks, sufficient to bring this kind of ditch into discredit; but while they are thus improper as open drains, owing to the circumstances we have mentioned, their shape is, he conceives, the best possible for a covered drain, as the broader these covered drains are at bottom, the more water will they carry off; with this additional benefit, that, by being broad below, they are less liable to choaking or obstruction than if they were narrow; in which case a single stone or two clapping close together will so far interrupt the course of the water, and so much sand and mud will accumulate behind them, as to render the drain useless; whereas, when there is a sufficient breadth at bottom, if the water is obstructed by one stone, it readily finds a passage in some other place."

The Simple Ditch, with a Bank of Earth, is a kind of fence that consists merely of a ditch sloping gradually towards the bottom; the earth taken out of it being generally formed into a bank on one side, leaving a scarcement, or projecting space, of six or eight inches, on the side where the bank is formed, to prevent the earth from tumbling in and filling up the ditch. The earth or clay, in some cases, is gathered into heaps, after being taken out of the ditches, and used as manure. This sort of fence is represented in this state in *pl.* XXXIX. *fig.* 1.

The Double Ditch, with a Bank between, is not often used, unless in cases where it is meant either to plant hedges or trees on the bank between the ditches. In some cases, however, double ditches are made, where there is no intention whatever of planting either hedges or trees, and in several instances are highly valuable. "Considered as a fence, it has, the writer just mentioned thinks, an evident advantage over the single ditch; as the earth taken out of the two ditches, when properly laid up in the middle, forms a pretty steep bank of a formidable appearance, which, without any other addition, makes a very tolerable temporary fence. For the purposes of open drainage, the double ditch is, he says, exceedingly adapted, especially by the sides of highways, where the lands have a considerable declivity towards the road: the ditch next the field, by receiving the water on that side, prevents it from overflowing and washing the road, a circumstance which very frequently happens in such situations; while the ditch on the side next the

road, by receiving and carrying off the moisture that falls upon, and which would otherwise lodge there and destroy it, keeps it constantly dry and in good repair. The double ditch is also useful in dividing high from low flat lands, particularly where the high grounds slope very suddenly down upon the low fields; that next the high grounds, by receiving the water from it during heavy falls of rain, saves the inferior grounds from inundation, while the ditch on the other side serves as an open drain for the lower fields. He trusts it will not be thought foreign to the present subject to mention, that, where double ditches are made in the immediate vicinity of high grounds, or on the sides of highways, care should be taken to prevent the water from the furrows, or side-drains, from running into the main ditch at right angles. Where this is neglected, much trouble and inconvenience arises; as when the water comes from the height, during heavy rains, in a straight line into the ditch, it presses with accumulated force against the sides of it; and if the soil is of a loose incoherent nature, the bank will be undermined and washed away in many places. To prevent this, nothing more is, he says, requisite, than to alter the direction of the furrows, or small side-ditches, a few yards from their opening into the main ditch; and, in place of permitting the water to fall upon the bank in a straight line, to give the furrows or side-ditches a gentle curve; by that means, instead of falling into the ditch in a straight line, and acting against the bank in the manner we have described, the furrows will empty themselves into it in an oblique direction; and, by joining immediately with the stream in the ditch, will be prevented from having any bad effect upon the bank. It is obvious, he thinks, that the water, by thus having its direction changed, can do no harm to the sides of the main ditch; and what is of advantage, the earth and sediment brought along with it from the high ground, instead of being deposited in that place where the cuts enter the main ditch, which seldom fails to be the case where the water falls into it in a straight direction, is carried off along with it; and though this sediment ultimately falls to the bottom of the ditch, yet, as it falls down gradually in its course, it is equally divided over the whole, and occasions no obstruction in any particular part of the ditch. This fence is shown at *fig.* 2.

The Bank-of-earth with a perpendicular Facing of Sod, and a Slope behind, is, it is observed, a very common sort of fence, and in some situations extremely useful; in making folds, for instance, for the confinement of sheep or cattle. It is also valuable on the sides of highways, for defending the adjoining grounds, and for laying off clumps or belts of planting in the middle or corners of arable fields, for inclosing stack-yards, cottages, gardens, &c. The front of the bank is made with the sod pared off from the surface of the sloping ditch, and the mound at the back with the earth taken out of it. In all cases, it is remarked, where this fence is used, the perpendicular front should be made on the outside, and the bank on the inside of the field. But when it is employed for folds, the front should be on the inside of the field; as in that way it will not only present a much more formidable appearance to the sheep or cattle, but the depth of the ditch will be an addition to the height of the bank; and the earth taken out of it, being laid behind, will serve as a kind of buttress to support the facing of sod, and give it a degree of firmness and durability far superior to that of the common turf walls, or *fold-dikes*, as they are generally termed in North Britain. When this fence is properly constructed, a work at which the labourers are now pretty expert, it lasts a considerable time; but, in its most perfect state, it is only to be considered as a temporary expedient; for, however neat it may appear, or however well it may answer the purpose at first, it ultimately loses its value. Where wood for paling is scarce, or cannot be had, and where other materials for the shelter or protection of young hedges are equally scanty, this may be used with advantage for a time, and will both shelter the young hedge, and inclose the field; but where permanent plans of inclosure are intended, it should never be had recourse to, as, however cheap it may be in the first instance, it is by no means durable. It is represented at *fig.* 3, which shows the section of a high-road with a bank on each side, and a perpendicular facing of turf or sod.

The Ha-Ha, or Sunk Fence, Mr. Somerville remarks, is calculated chiefly for fields that require no shelter, and where an uniform unbroken prospect is an object, as is the case in gardens and extensive lawns: but in all situations where shelter is wanted, the sunk-fence ought to be avoided, unless a hedge is planted upon the top of it. The form of the sunk-fence very nearly resembles the mound of earth, with the perpendicular facing of turf, just now described; with this difference, that the facing of the former is stone, and the height of the fence depends entirely, or in a great measure, upon the depth of the ditch. These sunk-fences are either faced with brick, dry stone, or stone and lime, and are of various heights, according to the ideas of the proprietor, or the circumstances of the case. In the Report drawn up on the Northern Districts, page 27, of the Account of Cromarty, the following description of the sunk-fence is, he says, given, which he begs leave to transcribe:—"Upon the line where this fence is intended, begin to sink your ditch, taking the earth from as far as eight feet outward, and throwing it up on the inside of the line. This ditch and bank is not made quite perpendicular, but inclining inward towards the field as it rises: to this is built a facing of dry stone, four feet and a half in height, one and three-quarters broad at bottom, and one foot at top, over which a coping of turf is laid: the ditch or sunk part forms an excellent drain. The whole of this is performed, when the stones (we shall suppose) can be procured at a quarter of a mile's distance, for 6*d.* per yard." It is seen at *fig.* 4.

In regard to the advantages of ditches, it has already been observed, he says, that "none of the different kinds of ditches, taken by themselves, are to be considered as good fences, with the single exception of the sunk-fence, which he was under the necessity of classing along with them. This last answers the double purposes of an open drain and a fence. But though ditches in their simple state are thus defective as fences, their use is, he remarks, attended with many advantages; not only in draining the field, but in affording a supply of earth, which, under proper management, may be converted into excellent manure. Where the soil in which ditches are made is deep and of a good quality, the earth taken out of them, if it is either made into a compost with lime or dung, or even spread by itself upon the adjoining fields, will, he says, greatly increase their fertility, and prove a lasting and valuable improvement. Even where the soil is moss or clay, it may be converted to the same valuable purpose by burning; moss being burnt, and the ashes used as a manure in many parts of the kingdom, and clay also. In the marshes of Somerset, he asserts, the clay taken out of the ditches and burnt is found, upon strong tenacious soils, to be highly valuable, as it breaks their cohesion, and by that means renders them not only less retentive of moisture, and of course easier cultivated, but also much more favourable to the growth of plants, by affording room for the roots to extend and stretch themselves out in search of food. Their value, as making a part of any of the compound fences, will, he says, be farther seen below," and under the articles *Ditch* and *Hedge*, &c.

Compound Ditch-FENCE.—*The Double Ditch and Hedge* is a kind of fence sometimes employed. In considering the double ditch as a simple fence, its use, and the various situations in which it is applicable, whether as a fence or an open drain, have been noticed. To what has been mentioned, we may add, the same writer says, that "the custom of inclosing with double ditches, and a hedge in front of each, is now practised in many parts of Britain, especially upon what are termed cold lands; from an idea, that a single row of plants would not grow sufficiently strong or thick to form a proper fence. The advocates for this fence farther allege, that, in addition to the two rows of plants forming a more sufficient fence, an opportunity is afforded of planting a row or rows of trees on the middle of the bank," as represented at *fig.* 5.

It is observed, that "the double ditch and hedge is liable to many objections: the expense of forming the ditches, the hedge-plants made use of, and the ground occupied thereby, being double of what is requisite in a single ditch and hedge. From twelve to eighteen or twenty feet is the least that is required for a double ditch and hedge: this space, in the circumference of a large field, is so considerable, that upon a farm of 500 acres, divided into fifteen inclosures, the fences alone would occupy above forty acres. By throwing up a bank in the middle, the whole of the nourishment, not only of both hedges, but also of the row of trees, is confined solely to that space, which, from its being insulated by the ditches, and elevated so much above the common surface, not only curtails the nourishment of the hedges and row of trees, but exposes them to all the injuries arising from drought, frost, &c. The idea of two rows of plants making a better fence than one is certainly no good reason for such an unnecessary waste of land and money; as, in almost every instance, where the plants are properly adapted to the soil and climate, one row will be found quite sufficient: but, if it should be preferred to have two rows, the purpose will be answered equally well with a single ditch, or even without a ditch at all; for in every situation where the soil is tolerably dry, and the fields much elevated above the level of the sea, the ditch, except for the purposes of drainage, may be dispensed with. In addition to the double ditch, and while the hedges are still young, the fence is sometimes strengthened by a paling, either of young firs or other wood placed upon the top of the bank: in other cases, a dead hedge is put in the middle between the two quick hedges, and not unfrequently an open wall, resembling a *Galloway-dike*, made with round stones, is placed in the same situation; any of which, when properly executed, not only inclose the field completely for the time, but also very effectually shelter the young plants" that constitute the fence.

Hedge-FENCES.—These are of two kinds; either such as are made up of dead materials, or such as are formed of living plants of some sort or other. "Dead hedges, it is observed, are made with the prunings of trees, or the tops of old thorn or beech-hedges that have been cut down; and are principally intended for temporary purposes, such as the protection of young hedges till they have acquired a sufficient degree of strength to render them fencible without any other assistance. For this purpose the dead hedge is well adapted, and lasts so long as to enable the live fence to grow up and complete the inclosure. In many cases, however, dead hedges are had recourse to as the sole fence, and where there is no intention of planting quicks, or any other hedge. From their very perishable nature, however, they are found to be exceedingly expensive; so much so indeed, that, after the first or second year, they cannot be kept in repair at a less expense than from a fifth to a tenth part of the value of the land, and sometimes more. When dead hedges are meant for the protection of young live fences, if the quick fence is planted upon the common surface, the dead hedge is made in a trench or furrow immediately behind it, in such a way as to prevent the sheep or cattle grazing in the inclosed field from injuring it. Where the quick fence, however, is planted upon the side of a ditch, the dead hedge is for the most part made on the top of the mound formed by the earth taken out of the ditch: these are called plain dead hedges, being made by cutting the thorns or brush-wood, of which they consist, into certain lengths, and putting them into the earth. We call them plain, in opposition to other descriptions of

dead hedges where more art is used: such as the dead hedge with upright stakes wattled, and the common plaited hedge bound together at the top with willows;" of which the reader will be able to form a much better idea than can well be conveyed by words, by consulting the plates; in which *fig.* 6. represents a dead hedge inclining a little, placed upon the plain surface in the ordinary manner; *fig.* 7. the common dead hedge, which, it is observed, is almost the only fence met with in several of the English counties, with the thorns or dead wood let into the earth about twelve or fourteen inches, and fastened at the top with willows or hazels; *fig.* 8. the wattled dead hedge, with strong upright posts, or what is generally termed *stack and rise*, or in Scotland *stake and rue*, and in some places *staff and band*. This last, and the one immediately preceding it, form, it is remarked, very handsome fences; it is only to be regretted that they are not permanent ones, seldom lasting above a year or two. This defect is complained of in many of the reports, particularly that of Lincolnshire: the words of Mr. Stone, the surveyor, are, that "dead fencing supplies the place of live, which occasions an eternal expense to the occupier: 1st, in purchasing the fencing stuff, and bringing it from a considerable distance; and, 2dly, in the delay of his interest, by reason that the land occupied by a dead fence might sustain a live one, which would not only answer the present purpose, but, in place of decaying, would be annually improving." The truth of this observation cannot be disputed; as the soil and climate, in almost every situation where these dead hedges are complained of, are such that hedges of live plants would not only grow, but could be made at equal, perhaps less, expense, than these temporary erections; and with this advantage, that, in place of decaying, and occasioning an endless loss and expense for repairs, they would be every year growing stronger, would require little expense to support them, and, in place of the forlorn decayed appearance which dead hedges never fail to give a country, they would at once shelter and ornament it.

It cannot, therefore, Mr. Somerville thinks, be too strongly recommended to proprietors and farmers, in those parts where dead hedges are at present so much used, and so justly complained of, to substitute live hedges in their place; the expense of doing so will be trifling, and the benefit arising therefrom immense. In carrying a plan of this kind into execution, there is no occasion to throw such fields as are at present inclosed with these temporary fences open; quite the contrary: the dead fences ought to be preserved till the young plants have attained such a strength and size as to enable them to form a good fence without any auxiliary aid. In that way the inclosure will not only be preserved, but the dead fence, from the shelter it will afford to the young plants, will accelerate their growth, and render them much sooner useful than they would otherwise be. This change of system would, he says, be at once pleasant and profitable to all concerned; the expense of inclosing, which is at present severely felt, would be done away; the appearance of the country considerably improved, and the public benefited in a great degree; and, as no doubts can be stated as to the practicability of this scheme, he trusts that the bare mention of it will be sufficient to dictate a better system of inclosing to those concerned. The idea entertained by some landlords, that, provided a farm is once let, with the usual burden upon the tenant of supporting the fences, the nature of the fence is of no importance to them, deserves, he thinks, the strongest and most pointed reprobation: indeed it could scarcely be supposed, that men who have a permanent interest in the property would reason in such a manner. There can be no doubt, if lands are let to a good tenant for a term of years, that the landlord is certain of drawing his rent during the currency of the lease, whatever the expense of supporting the fences may be; but if this tenant is a man of sense, the offer he makes will proceed upon the value he has in his own mind formed of the nature of the soil, and the expense which must unavoidably arise from cultivating and sheltering it, and bringing the produce to market: the farmer who has not made, or is not capable of making, such a calculation, can never be a desirable tenant to any proprietor; but if the tenant possesses this necessary knowledge, the yearly rent he will offer for the farm will be less in proportion to the sum which he expects annually to expend in constructing or supporting these fences. He trusts slender observation is necessary to convince intelligent proprietors or farmers, that the substitution of live for dead fences will not only make the inclosures more perfect, but will make an addition to the annual value of the property, equal to, if not greater than, the expense at present incurred in keeping these dead fences in repair. It need, he thinks, hardly be added, that, as the greatest value of these fences consists in their completing inclosures, and sheltering the young hedges till they arrive at a certain age, they should never be thought of by either proprietors or farmers, except for these or other temporary purposes.

In respect to *live hedges*, it is observed, that they are made either entirely with one kind of plants, or a mixture of different kinds; and for that purpose almost every tree or shrub known in Britain are either wholly or in part employed. Under the head *Inclosing of Land*, some account is given of each; but there are certain circumstances common to all of them, and upon which the success of every attempt made to rear good fences will be found ultimately to depend. "These circumstances are," the above writer says, "1st, The plants being suited to the soil and climate; 2dly, The preparation of the soil; 3dly, The time and mode of planting; 4thly, The age of the plants; 5thly, The size of ditto; 6thly, The dressing or pruning of the tops and roots before planting; 7thly, Weeding and hoeing ditto; 8thly, Pruning and after-management; 9thly, Filling up gaps in hedges; 10thly, Diseases to which hedge-plants are liable, and their remedies."

In regard to the first, it is observed, by the same author, that "upon the proper choice of plants suited to the soil and climate where the hedge is to be made, the success of every attempt to inclose with live fences will be found to depend. A mind given to observation, and capable of applying it in practice, may receive considerable assistance upon this point by attending carefully to the indigenous trees or shrubs which thrive best, and attain the greatest size, upon particular soils and in certain climates: by an attention of this sort, many plants, which are seemingly of small value at present, might, it is remarked, be rendered highly useful by planting hedges with them. But though an observation of this kind will in some instances serve as a guide, and lead the person who makes it to certain useful practices, it is not always to be depended upon, as there are many situations where neither trees nor shrubs fit for making hedges are to be met with in an indigenous state; and even when they are met with, their nature will not admit of their being transplanted. Fortunately in these cases, though nature affords no guide to assist us in the choice of the plants, we shall find sufficient direction from the experience of the country, by carefully noting the circumstances of soil and climate, under which certain plants that have been introduced into them have prospered, and either risen into trees, or made good fences. In speaking of the nature of inclosing land, notice has been taken of the great loss which attends the fence, and the plants of which it consists, in not being properly adapted to the natural circumstances of the soil they are meant to inclose. Many mistakes of this kind might be enumerated; especially in the more elevated situations, where great labour and expense have been employed to raise hedges of hawthorn, which, after many years care and attention, were found totally unfit for such inclement regions. In such situations, experience has now sufficiently proved, that good fences can be reared in a short time with beech, birch, larch, and the Huntingdon willow: hedges of these kind ought, therefore, to be the only ones used in hilly countries, or upon cold wet soils; the three first upon the dry soils, and the last, with the addition of poplars, upon such as are wet or marshy. In the low country, however, and in the less elevated parts of the uplands, the white-thorn will be found the best upon all the dry, or moderately dry, parts of the soil; especially the different kinds of loamy, sandy, or gravelly lands: upon clays, or cold wet soils, however, beech, crab, birch, poplar, willow, and alder, may be used with advantage. The birch, poplar, alder, and Huntingdon willow, are peculiarly calculated for the coldest, wettest, and most marshy parts; while beech, crab, &c. will be found to answer best upon the stiff clays. Hazel, sweet-briar, rowan-tree, and indeed all the different kinds of forest-trees that are at present known to delight in dry soils, may also be employed for making hedges in the low lands with success; but whichever of these is used, they should, if possible, be without mixture. See *Inclosing of Land*.

It is seldom indeed that any soil, however good, will be found equally favourable to the growth of plants so very opposite in their nature; this circumstance alone will render their growth unequal, and of course make the fence faulty and defective. These defects in the fence, and inequalities in the growth of the plants, will increase with time, become every day more apparent, and be every day more sensibly felt; as the plants which have thus acquired the ascendency will continue to keep it, and not only shade the weaker ones, and prevent them from enjoying the influence of the sun and air, but also deprive them of nourishment. Independent of these considerations, there is another, it is observed, of equal, perhaps greater, moment, that requires to be mentioned; allowing the soil to be equally favourable to the growth of the whole plants of which the mixture consists, there are certain plants which are highly inimical to the growth of others, when planted in their immediate vicinity; ivy and honeysuckle, for instance, when mixed with thorns, or other plants in a hedge, never fail to destroy such of the hedge-plants as they fasten upon; indeed moss, which is known to be one of the worst enemies to all hedges, is not more dangerous or more certainly ruinous; even the different kinds of sweet-briar, brambles, &c. have the same effect; and in the end never fail to produce a gap in that part of the hedge where they grow, by corroding and smothering the thorns or other plants."

With respect to the second, or the preparation of the soil for hedges, and even plantations, it is said, that, "though at present shamefully neglected, it is nevertheless one of those points intimately connected with, indeed essential to, their success. Except in a very few instances, however poor the soil may be, or however strong the cohesion of its parts, no attempt is made either to break that cohesion by tillage, or improve its quality by enriching or alterative manures: the young plants being for the most part laid upon the old surface, which has perhaps never been opened by the labour of man, and their roots covered with the earth taken out of the ditch, consisting very often of the poorest and coldest *till*, or of earths loaded with iron or other metallic impregnations. To those who have considered the matter with the smallest attention, the fate of such a hedge will not appear doubtful; the surface upon which the plants are laid will be so hard and impervious to the roots, as to preclude the possibility of their penetrating it; of course, their only chance of either extending themselves, or procuring nourishment, is by spreading out between the surface and the mound made by the earth taken out of the ditch, or by striking up into the mound, where, though the soil will be sufficiently open to admit of this, the roots, in place of finding an establishment in a situation friendly to their growth, will very often be either starved or poisoned.—In the culture of the grain, and the whole of our most useful and valuable vegetables, proper preparation of the soil by tillage and manures is, it is remarked, deemed indispensably necessary; and experience has sufficiently evinced,

that, upon the perfection of the tillage, and the quality and judicious application of the manures, the success of the farmer or gardener, and the value of their crops, entirely depend. Is it not strange then, says the author, that the same farmer who is convinced of the utility and necessity of tillage and manures for his other crops, and who would think himself for ever disgraced were he to sow or plant grain, or any other useful vegetable, upon an unploughed, dirty, unmanured field, should, without shame or compunction, commit a hedge, which is to form the inclosure of the field, and upon which a considerable part of its future improvement is to depend, to the earth, without any one of these aids? Incredible as it may appear, this is certainly the fact; unless, as has formerly been observed in a few instances, where better sense and stronger observation have dictated a different management; it being the uniform custom in most plans of improvement, be the quality of the soil what it may, to mark off the line of the fence, dig the ditch, and commit the hedge-plants to the earth, without any previous preparation, either by tillage or manures. In every instance where a hedge is to be made, the ground should, it is contended, be previously prepared by a complete summer fallow, in order to destroy the weeds; when this is accomplished, a certain proportion of dung, lime, or compost, should be laid on the tract upon which the hedge is meant to be planted; after this is done, and the manure properly incorporated with the soil, a furrow should be drawn with a common plough about the end of November; in this furrow the plants should be placed, and the earth thus impregnated with the dung or compost drawn up to, and trod firmly about, their roots. When the soil has been previously cleared of weeds in this manner, and a sufficient quantity of manure bestowed, the hedge, if the plants are healthy, and suited to the soil and climate, may be committed to the earth, with every prospect and chance of success."

In regard to the third circumstance, or the time and mode of planting, it is remarked that, "of whatever plants the hedge is made, they ought always to be put into the ground, either before winter, or very early in the spring, before any vegetation takes place. In that way, if the plants have been carefully taken out of the nursery-ground, and no material injury done to their roots by laceration, pruning, or otherwise, their growth receives scarce any check, and they make more progress in one year than they would do in three or four years under different management. The beginning of November, or any time during the month of January, seems the most proper time for planting thorns. The mode of planting, it is observed, differs in different places, and even in the same place, according to the nature, of the hedge: when hedges are made in the face of a ditch, bank, mound, or wall, the universal practice is to lay the plants horizontally, either upon the surface, or upon a paring of sod or earth taken from it; and afterwards cover them in such a manner as that about seven or nine inches of their length shall be covered with the soil, and about three inches left projecting without it. In that way, sufficient room is left for the roots stretching out and forming an establishment for the plant; while the part left projecting is so short as not to be able to produce above two, or at most three, good shoots, which, from the smallness of their number, will be vigorous and useful; whereas, if a greater length had been left without being covered, the shoots would have been much more numerous, and of course weaker. The future value of the hedge depending entirely on the number and strength of the first shoots the plants make, we have already hinted at the necessity of preparing the soil properly, by tillage and manures, in this mode of planting, viz. upon the plain surface in the face of a ditch, bank, mound, or wall, it is equally necessary as in any other; dung, lime, or compost, ought to be laid upon the tract, and pointed in with a spade; and in place of laying the earth taken out of the ditch indiscriminately upon the roots of the thorns, care ought to be taken to cover them with the best of the surface mould: by such treatment, having a well prepared, well manured, bed below, and a covering of good earth above, the roots of the plants have not only abundant room to spread, but have also plenty of nourishment; this gives them a decided advantage at their first starting, and enables them to make more progress in two or three years than they would otherwise do in twice that length of time.

"The mode of planting a hedge upon the common surface is very simple; a furrow about eight or nine inches deep is made with a common plough upon the tract that has been previously limed and dunged; to render the furrow as clean as possible, the plough should be drawn twice along it; one labourer then goes along the furrow with a bundle of plants under his arm, which he drops in handfuls of six or eight together at certain distances: when he has gone over perhaps a hundred yards in this manner, he returns to the farther end, where he began to drop the plants; and, taking up the first handful, begins to set them in the bottom of the furrow, not in a direction perpendicular to the horizon, but inclining a few degrees in the same direction that the fence runs. These the labourer places, leaning against the perpendicular side of the furrow, at the requisite distance from each other, as from four to six or eight inches: having placed the whole of them in this manner, he covers them with the earth from the other side, or that which has been turned up by the plough: when this operation is finished, he sets a foot on each side of the hedge, and, beginning at one end of it, goes slowly along, treading the earth close to the roots of the plants the whole way; the soil is then pointed with a spade on each side, which finishes the operation. Where the necessary pains have previously been taken to pulverise the soil, a single labourer will, with great ease and exactness, plant several hundred yards of thorns or other hedge-plants in the course of one day." Another mode, it is observed, consists "in one labourer receiving the plants, by two or three at a time, from another,

who carries a bundle of them, setting them in the middle of the furrow, with the top reclining a little, and drawing a quantity of earth from each side with his foot to cover the roots: when about fifty or a hundred yards are done in this way, each labourer takes a common garden-rake, and draws up a sufficient quantity of earth to each side of the plants; treading the surface with their feet as they go along, in such a manner as to bind the soil moderately, and at the same time set the plants in a straight line. A third mode consists in harrowing the tract of the hedge, or raking it with a garden-rake; then stretching a line along it, laying out a furrow with the spade, and afterwards planting the thorns, and laying the earth to them, in the manner described in the two former methods. Laying out a furrow with the spade in this manner, admits of the work being done with great neatness and accuracy; but it is attended with considerably more labour and expense, and, after all, seems to possess, no great superiority over planting with the plough. In some cases, the hedge is planted with the dibble, but, as we shall afterwards have occasion to notice, this practice must be a bad one; for if the plants have the whole of their roots preserved, and are planted with a dibble, in place of the fibres being properly spread out, as they ought to be, they will be crammed together into a very narrow space, with their points staring upwards, or, in other words, looking out of the soil, in place of dipping into it; or if by much pruning they are cut so close as to be made fit for going easily into a dibble-hole, their growth will sustain a severe check by such injudicious pruning:" when hedges come afterwards to be spoke of, as making a part of any of the compound fences, the circumstances connected with the planting of each will, however, be more fully noticed and described.

With respect to the age at which hedge-plants ought to be used, "it is very common, especially where young hedges are made with quicks, to plant them of one, two, or three years old, seldom exceeding this last age. Plants of this description, when put into the earth at a proper season of the year, upon land that is well prepared, and that are afterwards carefully kept clean, and the earth soft and loose, by regular weeding and digging, seldom fail to make good fences; such young plants, however, are, it is observed, long in a state of infancy, and require great nursing and the most complete protection to bring them to perfection, and are liable to be either much hurt or totally destroyed by many accidents that would produce little or no effect upon older and stronger plants. It is the opinion of many sensible and well-informed people, that much time might be saved in the rearing of hedges, and the fences be much more perfect and useful, if older plants were employed for that purpose. Three years old is certainly the youngest that should be planted, and if they are even six or seven years old, so much the better: the prevailing idea that plants of that age will not thrive if transplanted, is, it is said, totally unfounded; as, with proper care, they not only grow readily, but make excellent fences in one half of the time that younger plants usually do; with this additional advantage, that they are much less liable to be killed or injured by frost, drought, weeds, or the other causes that affect younger plants. Thorns of six or seven years old, in place of being no thicker than a common straw, will be at a medium more than an inch in circumference: we leave those who are judges to determine how far a plant of this last description will be superior to one of two years old, and how much sooner it will answer the purposes of a fence. It is, however, very material to observe, that, where plants of this age and size are used, the most complete care should be taken to preserve the roots as entire as possible. The degree of pruning which may be necessary before planting, will be mentioned afterwards. In respect to the size of thorns or other hedge-plants, it may be necessary to observe, that, when the plants are once obtained, they should be separated into sorts, according to their size and apparent strength, picking out the largest first, and so on downwards. This will be attended with several very material advantages, which those who have made observations on the subject will very readily understand; plants of the same size and strength, when planted together, keep pace with each other; no one of them takes from the earth more than its own share of nourishment, of course the growth of the whole is regular and uniform; and the hedge, when arrived at a certain age, becomes a substantial efficient fence, of an equal height throughout, and free of any gaps: whereas, when no pains have been taken in assorting the plants, and they are planted promiscuously, great and small, strong and weak, the consequence is, that the strongest plants very soon outgrow such as are weaker, and not only overtop them, but also deprive them of that nourishment which they so much require: as the hedge advances in age, the evil becomes greater, small stunted plants and innumerable gaps appearing throughout the whole line of the fence; these are interspersed with others remarkable for their strength and luxuriance, the whole conveying to the mind not only the most distant idea of utility. And the worst part of it is, that, when hedges have been thus neglected in the beginning, no pains or industry on the part of the farmer will be sufficient to render them useful afterwards; there being nothing more difficult than that of repairing the defects of a hedge, after the third or fourth year of its growth. This assorting of hedge-plants has, it is remarked, a farther advantage; namely, that of putting it in the power of the person who plants the hedge to put down the large, strong, healthy plants upon the poorest part of the line of the fence, and to set such as are smaller and weaker upon the richer and more fertile parts. He has it also in his power, by a more careful preparation of the soil, and bestowing a greater proportion of manure upon the spaces where the small plants are set, to give them that nourishment and assistance which they require, and which would very soon enable them to form a fence equal to that part occupied by the strongest plants."

In regard to the dressing and pruning of hedge-plants before they are put into the earth, "there is perhaps no part of the system of managing them, or forest trees, more hurtful and defective than that now pursued in the common nurseries. It is a very common practice with nurserymen, in the spring, when they wish to clear their ground for other purposes, to take up great quantities of thorns and other hedge-plants; and after pruning the tops, and cutting off nearly the whole of the roots, to tie them up in bundles, and lay these bundles in heaps till they are called for. In that mutilated state they often remain for many weeks, with the mangled roots naked and unprotected, exposed to every inclemency of the weather, before they are sold. The consequence is obvious; the severe pruning, by curtailing the number of the roots, and depriving the plants of the means of drawing their nourishment from the earth, would of itself prove an effectual check to their future growth, even if they were planted immediately after this severe trimming; but by being allowed to remain so long exposed to the weather afterwards, the tender fibrous extremities of the remaining roots are most of them destroyed; and when the plants are then put to use, they are not only half dead, by being so long exposed above ground, but are as it were insulated, and their connection with the earth cut off by the severe pruning and destruction of their roots. Under these unfavourable circumstances, they must remain in the ground till new roots are produced, during which period they suffer a total want of nourishment; and if the soil be dry, and much warm dry weather follows the planting of the hedge, many of the plants will perish, before they are capable of pushing out, and producing a number of new roots sufficient for their support: accordingly, many of them fail from these causes; and numbers of hedges, which, under different management and with small trouble, would soon have been complete fences, are full of gaps, and remain for ever after in an imperfect state. When thorns or other hedge-plants are thus severely handled, and their roots and tops so unmercifully cut off, they resemble, it is observed, cuttings more than plants, and must remain a very long time in the earth before they are capable of sending out new roots, or drawing from it a quantity of nourishment adequate to their support. Were nurserymen and others, says the author, to bestow the smallest attention upon the subject, common sense would dictate a very opposite treatment. Men of observation know, that in every instance where either trees or herbaceous plants are to be transplanted, the more carefully they are taken out of the ground, the more numerous and entire their roots; and the sooner they are again put into the earth, the less check will they receive, and the quicker and stronger will they afterwards grow. If these observations are just, how faulty and defective, says he, must the system we have just now described appear! Indeed nothing can be more repugnant to nature and common sense, than to suppose, that when plants of any description are removed from the situation in which they are growing, and sent to such a new establishment in a different soil, and perhaps a worse climate, they will thrive better by having their roots cut off, and being almost entirely bereft of the means of obtaining nourishment. With equal probability might success be expected from planting a colony with people, after having completely mutilated them, by cutting off their hands, putting out their eyes, &c. &c. In place of this treatment, the defects of which are so obvious, and the consequences resulting from it so hurtful, no hedge-plants should be lifted out of the nursery-ground till the day on which they are to be replanted; and instead of digging them with a spade, by which they are often much injured, they should be taken up with dung-forks, with strong round prongs, taking care to disengage the roots carefully from the soil, and in place of the severe pruning and dressing already mentioned, every root, even to the smallest fibre, should be carefully preserved, and the use of the knife confined entirely to the necessary curtailing of the tops." Where this care is taken, and the plants are put into the ground at a proper season, they will suffer no kind of check, and when the spring arrives grow luxuriantly and with vigour.

It is farther observed, that "much of the benefit arising from an attention to the foregoing circumstances will depend upon the after-management of the hedge. Complete weeding, loosening, and laying new earth to the roots, for the first three or four years, are indispensable requisites; for, whatever pains may have been previously taken in dunging and summer-fallowing the soil, unless it is properly attended to and kept clean afterwards, this dunging and summer-fallow, in place of being useful, will prove hurtful to the fence; as the manure and tillage, by enriching and opening the soil, will encourage and promote the growth of weeds; which, under circumstances so peculiarly fortunate, will become so luxuriant, as either to destroy or materially injure the growth of the hedge, unless they are kept down by frequent and complete cleanings. These weedings are of two kinds, and ought to be conducted in two different ways. If the weeds are principally annuals, a slight scuffle with a hoe will be perfectly sufficient; and this to be repeated as often as a new crop of weeds appears; but when the weeds, in place of annuals, are composed of root-weeds, or, in other words, of perennial or biennial plants, the extirpation of these last will be attended with more trouble. With weeds of this description scuffling will not answer, as, though the tops may be cut off by that operation, the roots remain, and not only furnish repeated crops of the same weeds, but also rob the hedge of its proper nourishment. In place, therefore, of scuffling and cutting off the tops of such weeds with a hoe, the ground ought to be carefully dug with a dung-fork, of the kind already described for lifting thorns. An instrument of this sort is preferable to a spade, as it cuts none of the roots of the hedge, loosens the ground sufficiently, and at the same time admits of the weeds being readily and easily picked out. The first weeding of

this kind that is given to a young hedge should be early in the spring, when, if it is completely done, there will be little occasion for any farther trouble during the season. Cleaning at that period has a farther advantage, namely, that of loosening the soil at the exact time when the roots are beginning to spread and extend themselves; whereas, when it is delayed till the summer, the weeds have attained a considerable size, have deprived the hedge of much nourishment, and the opening of the soil then exposes the roots of the hedge to the parching heat of a summer sun. In the cleaning of young hedges, especially such as are situated in the face of a ditch or bank, it is the universal custom for the labourer to skim off the surface with a spade, and let it fall into the bottom of the ditch. This operation, though it gives the hedge an appearance of cleanness, is attended with some very considerable disadvantages; repeated parings of that kind, in the face of a ditch or bank, in a few years, waste the front so much as in some degree to undermine the hedge, which, after frost or wet weather, is apt to slide and tumble down; the paring off and throwing into the bottom of the ditch so much earth, together with the roots and weeds it contains, very soon choaks and fills it up. Notice will afterwards, it is observed, be taken of the necessity of constructing hedge-fences in such a way as that the hedge shall not project immediately from the front, but shall be placed upon a shelf, or what is termed a scarcement, of not less than twelve or fourteen inches broad. By such management, the hedge will run no risk whatever of being undermined by the earth falling into the ditch, and may be kept clean with as much ease as a common garden-border. The proper method of cleaning a hedge planted in this manner seems to be that of digging the border with a short-pronged fork in the spring, picking out such of the weeds as can be readily taken up by the hand, and afterwards raking it with a garden-rake; this last operation, along with its making the surface smooth, and giving the work a finished look, will also bring out a great number of the smallest roots that had escaped the labourer's notice in digging it with the fork. Some imagine, that by a slight weeding once or twice a year, for the first two or three years after the hedge is planted, they do all that is requisite: this, however, is a mistake; for though a hedge may, by care and attention for the first five years of its growth, attain such a height as will prevent it from being smothered by the weeds, still it will suffer much injury from them, not simply by the nourishment they take from the hedge, though that must be considerable, but by the effect they have upon the lateral branches near the root, many of which they kill, and by that means render the fence open and naked at the bottom. Skilful hedgers are well acquainted with this circumstance, and very properly consider annual cleanings, and loosening the soil about the roots, as equally necessary to the welfare of the hedge, as the other operations of switching, pruning, &c. &c. The apparent trouble and expense of cleaning every description of hedge yearly, will no doubt present a formidable obstacle to the practice; but, when properly considered, this labour and expense will be found more apparent than real; for if a proper weeding has been given when the hedge was first planted, and the earth well opened, the only trouble required afterwards will consist in giving the ground on each side of the hedge a slight scuffle with a hoe, a work at which a labourer will be able to do a very great deal in the course of a day. To this practice of keeping hedges clean, with a view to promote their growth, is to be added another motive, of equal, indeed of superior, moment:—round most of the inclosed fields in Britain, the space occupied by the fence is considerable; and as no part of this space is under the plough, it is left to produce such plants as nature or accident may have brought into the soil: these, by being suffered to grow, and their seeds to ripen yearly, are wafted by the wind into the adjoining fields, where they multiply beyond conception, and create an endless trouble to the occupier, rendering abortive a great part of the labour and expense incurred in fallowing. A person who is sensible of the advantage arising from the extirpation of weeds of every description, either in the fields or their immediate vicinity, must feel a considerable degree of pain, to observe, about the end of summer, clouds of the winged or bearded kinds rising from the side of every hedge or highway with the slightest breeze of wind, and scatterring themselves over the adjoining fields, which have been perhaps fallowed the year before at a heavy expense: the evil is undoubtedly great, and affects the innocent as well as the guilty; it being no uncommon thing for the best farmers to have their fields rendered foul, by the wind blowing the weeds of their slothful dirty neighbours upon them. The remedy is easy: let every farmer be obliged to cut down the weeds round the whole line of his fences, so early in the season as to prevent them from running to seed; and let the trustees in every county, in making contracts for the repair of the public roads, bind the contractor to cut down the weeds annually." The labour of these operations will, it is observed, be very trifling, and their benefit to the public immense.

It is remarked, that "in loosening the earth about the roots of hedges, whether old or young, it will be of advantage, if there is soil enough to admit of it, to lay up a few inches of it to the roots; doing this frequently encourages them to push out branches near the bottom, which prevent them from growing thin and open,—a fault to which almost all hedges are liable, if due pains are not taken to prevent it. When a hedge has been planted in the face of a ditch, bank, or mound, with a projecting space or scarcement before it of sufficient breadth, a supply of new earth may be laid up to the roots every two or three years, from the sediment let fall by the water in the bottom of the ditch; this sediment is in general the richest of all soils; and as it is necessary to remove it from the bottom of the ditch, for the purpose of cleaning the water-course, employing it in this way not only saves the trouble of carrying it elsewhere, but promotes the growth of the hedge, and gives the

fence a much more finished look. Upon the sides of highways, the same thing may be done with advantage not only to the hedge, but the road also: for though there may be no ditch to require cleaning, yet as most of the highways in Britain have a greater or less declivity towards the sides, the decayed materials of which the road is made, together with the horse-dung and other matters dropped upon it, are washed down from the top to the sides, where they accumulate in considerable quantities; shovelling this carefully up, and laying it to the roots of the hedge, affords the plants at once protection and nourishment. Where hedges are planted upon the plain surface, the earth can be laid up to the roots with great ease; and at each cleaning it certainly should be done." The trouble of doing so is trifling; the advantage very considerable.

In speaking of the pruning and after-management of hedges, it is observed, that "though a strict attention to the foregoing circumstances, during the infancy of a hedge, is highly necessary to produce healthy vigorous plants, a very considerable part of its beauty and future value will depend upon these being properly performed."

It is remarked, that "there is, perhaps, no part of the subject upon which a greater contrariety of opinion at present prevails, than the age at which the pruning of hedges ought to commence, the manner of that pruning, or the season of the year at which it may be given with the greatest possible advantage and the least risk; the practice with some is, to prune, from the first year, not only the lateral branches, but the tops also; and give as a reason, that cutting off the extremities of the shoots contributes to thickening of the hedge, by making them push out a great number of new ones. The fallacy of this argument, and the mischief with which the practice is attended, we shall have occasion to notice afterwards. As to the manner of pruning, or the form of the hedge, these seem, with many, to be matters of indifference, no attention being paid to dressing them in such a way as to have them broad at bottom, and tapering gradually towards the top: many of them being not only of one width from top to bottom, and not a few much heavier and broader above than they are below, it is obvious that such hedges can neither look well nor be useful. The season at which they are trimmed is in many instances, it is observed, an improper one; for in place of choosing that time when the plants are least in danger of suffering from an effusion of their juices, which is either at a late period in the autumn or very early in the spring, the pruning is given in the summer-season, when vegetation is in its prime, and the plants are full of juices: the check and injury they must receive from having the whole of their extremities cut off at that period may easily be conceived. In speaking of the treatment of hedge-plants before they are put into the ground, notice has been taken of the necessity of preserving the roots as much as possible, and at the same time shortening the tops: this last operation has two good effects; for, by curtailing the top and branches, the roots have less to nourish; and by leaving only two or three inches of the top above ground, in place of growing up with a single stem, it sends out two or three; and as these strike out from the plant so near the earth, each of them has the same effect, and stregthens the hedge as much as the original stem would have done by itself; with this addition, that, in place of one prop or support, the hedge will have three or four. After this first pruning, however, no hedge should be touched, or at least very gently, for some years; from an inattention to this circumstance, and the injudicious application of the knife or shears at an early period, many young hedges are rendered useless, which, under different treatment, would have made excellent fences, with one half the trouble that was required to destroy them. The practice of cutting over the tops yearly, which is done with a view to render the hedge thicker and more perfect, is, he says, one of those mistakes which we would naturally have supposed common sense and observation would have sooner corrected; the effect produced being, in almost every instance, the very reverse of what was intended: shortening the main stem of a thorn or any other plant makes it brush out a number of small stems immediately at the place where it has been cut; and if this operation is repeated once or twice a-year, every one of these is again subdivided, as it were, by sending out more branches: thus, in a course of years, during which the hedge makes very small progress upwards, if it be examined, instead of being found to consist of strong vigorous plants, with a good main trunk, each reaching from top to bottom of the hedge, and a sufficient number of lateral branches throughout the whole length of it, it will be found, by such repeated cuttings, in the same stunted situation as certain young trees and shrubs that are frequently cropped by sheep or cattle. From the repeated crops of young shoots which the tops send out after every clipping, and the great quantity of nourishment necessary to support such additional numbers, the lateral shoots at the bottom, upon the strength and numbers of which the value of the hedge in a great measure depends, are stinted in their growth, and soon die; the hedge, of course, becomes open and naked at the bottom, and consequently useless as a fence. Where the hedge has been thus ruined, there is, it is remarked, no remedy but cutting it over, close by the ground; this will immediately produce a number of healthy, vigorous, upright stems, which, under proper management, will soon form a good fence. From the first year of planting, till the hedge has risen to the height of five or six feet, the main stems ought to be left untouched, and the pruning confined solely to the side branches, leaving those next the root pretty long, and gradually tapering towards the top: this pruning of the side branches will make them send out many new shoots from their extremities, which, by repeated trimmings, will become so thick as to fill up every interstice from top to bottom of the hedge; while the main stems, by being left untouched, continue

their growth upward, till they arrive at the necessary height, when they may have their extremities cut off with perfect safety. When a hedge has attained the wished-for height, all that is requisite afterwards is regular switching with a hedge-bill, preserving it pretty broad at bottom, and drawing it gradually to a point at top: this form of a hedge is pleasant to the eye, is well calculated to stand the weather, and, by being thus above the nourishment that would have been wasted in supporting a thick, bushy, overgrown top, is retained by the branches at the bottom, which are thereby strengthened, and their numbers considerably increased; while the trunk, by having no more exertion to make in an upward direction, becomes every year stronger and thicker. A hedge of this sort in full leaf has the appearance of a solid wall; and, when viewed after the leaves are shed, presents to the eye a set of massy growing piles, so strong and formidable as to bid defiance to any attempts that may be made to break through them." A hedge trimmed in this way is represented at *fig.* 9.

In the cutting down of old hedges, the above directions and observations apply, it is observed, with strict propriety only to such as have been regularly attended to from the time of their being planted: "as there are, however, innumerable hedges in the kingdom, which, by being neglected, have grown up to a great height, have become open and naked below, and bushy and unmanageable at top, it is of consequence to point out the means of reducing such hedges to a moderate scale, and rendering them useful. This purpose, it is stated, can only be effected by cutting them down, and procuring from their stumps a growth of new shoots, which, with proper management, will soon make a perfect fence. If the fields inclosed by such hedges are alternately in pasture and tillage, the period most proper for cutting them down is when the field is to be ploughed. Under a corn-crop, the confinement of the stock is no longer an object; and by the time the field is again brought under the plough, the hedge, if properly treated, will have acquired strength enough to become a good fence. This operation is performed in several different ways; in the first, the hedge is cut over, about a yard above the surface, and is left in that state without any other pains being taken with it; if it has originally been good, and the plants thick enough at bottom, this kind of cutting will answer the purpose perfectly well, and in a few years the hedge will, with proper dressing, become both a neat and an useful fence." A hedge cut over in this way, with one year's growth of new shoots upon it, is represented at *fig.* 10.

But in this mode, when there has been a deficiency of plants, and the hedge is cut over in the manner above mentioned, innumerable gaps will appear, which, without some art, it will be impossible to fill up. It has also this farther disadvantage, that if either horses or cattle attempt to leap into, or out of, the inclosure, the sharp points of the stakes are apt to run into their bellies: this accordingly often happens, and many valuable horses and cattle are killed or greatly injured by such means.

Another and indeed a preferable mode of cutting down old hedges is, it is observed, to cut a fourth part of the plants over, to the height which the fence is intended to be made, and to bend down and warp the remaining three-fourths with these upright stems. This method very effectually cures the gaps and openness below, and with slight attention soon makes a good fence. *Fig.* 11. is a representation of a hedge done in this way.

A third way of cutting over old hedges is that of cutting them close by the surface; this practice, when the plants are numerous, and there are no gaps in the hedge, answers very well; but when there is a deficiency of plants in any part of the hedge, the want will be very apparent. This last mode, though much inferior to the one immediately preceding, is neverthelcss greatly preferable to that first described, as the young shoots sent out from the stumps, by being so near the ground, will in some measure remedy the defects occasioned by the want of original plants; whereas, when the old plants are cut at the distance of about a yard or four feet above the surface, the young shoots produced by the cutting will be so high, as to leave the hedge open at the bottom.

The last method of cutting down old hedges, and which is yet but very little practised, is first to cut them down even with the surface, and afterwards to cover the stumps completely over, with the earth taken out of the ditch, or from the road-side. When this is carefully done, it is asserted that every single root sends out a great number of young vigorous shoots, each of which, by branching out from the stump below the surface, sends out roots, and acquires an establishment for itself; by that means the bottom of the hedge becomes so thick, that neither sheep, cattle, or indeed any animal, can break through it. In whichever of these ways the hedge is cut down, the directions formerly given for the management of *young* hedges should be strictly attended to, as soon as the young shoots have made some progress; the side branches should be trimmed, and the hedge put into a proper shape, preserving it broad and full at bottom, and tapering gradually towards the top. The same caution is also to be observed with regard to the upright shoots, none of which should be shortened till the hedge has attained the wished-for height. It is surprising what close beautiful fences are raised in this way, in a few years, from the stumps of some overgrown useless hedges; which, at the same time with their being naked below, and of course faulty as fences, occupied four times the space they ought to have done, to the great loss both of the proprietor and farmer. The observations formerly made, with regard to the proper season for pruning and switching young hedges, apply with equal, indeed greater, propriety to the cutting down of old ones; as, if this operation is done at an improper season, from the largeness of the stumps, the extent of wounded

surface exposed to the weather, and other circumstances, the plants are in imminent danger of being destroyed: indeed this very often happens, when, through ignorance or inattention, the proprietors of hedges have them plashed or cut over during summer. It is unnecessary in this place to enter into any digression as to the use of leaves and branches to plants of every description; it is sufficient for the present purpose to state what experience and common sense have abundantly proved, viz. that the loss of either, especially when the plants are in a growing state, and the juice circulating through them, is in most cases attended with the destruction of the plant: indeed the thing speaks for itself; the juice of the plant, instead of being employed in nourishing the top and branches, flows in great abundance through the section of the trunk, and, by finding so ready an exit, draws from the root a quantity of nourishment far exceeding the proportion required for its former support: by such an unusual drain, the plants are exhausted, or, as is commonly said, they bleed to death. It is to be observed, however, that every description of plants is not equally affected by a summer cutting; those that are most juicy and succulent, and have the largest circulating vessels, always suffering more than such as are of a harder texture, have smaller pores, and less sap circulating through them. The birch, larch, poplar, willow, and in general all plants that contain a large proportion either of resinous or saccharine matter, are to be ranked in the first class; the different kinds of thorn, crabs, &c. &c. belong to the second: the former are almost infallibly killed by a spring or summer pruning; while the same operation is often practised upon the latter with little apparent injury. But though we thus readily admit that one description of plants will survive an operation by which others would be killed, it by no means follows that they are not injured thereby; there are, indeed, too many proofs to the contrary, as in almost every county there are thorn-hedges met with that have been plashed or cut over in summer, and which, though they have not died in consequence of the operation, yet by the loss of juices, and the exposure of their naked trunks and wounded extremities to the parching rays of a summer sun, have been so much weakened as to prevent them from putting out new shoots, and have ever afterwards remained in a naked state, exhibiting an appearance no way better than that of a dead hedge. This picture is the very reverse of what, under different treatment, would have been the case; as, when the old plants are cut over at a proper season, a healthy luxuriant crop of young shoots never fails to be produced. The proper season for cutting over hedges is either at a late period in the autumn, or very early in the spring: at both of these periods, the plants are equally safe from injury; at the former the juices are retiring towards the root, and early in the spring they have not begun to rise. In either case no danger whatever can arise from the bleeding of the plants, as, long before the circulation takes place, the wounds occasioned by the cutting will be completely healed: all cuttings or trimmings ought therefore to be done at one or other of these periods.

In respect to filling up gaps in hedges, it is remarked that "when young hedges are planted, if the plants made use of are of a nature suited to the soil, the hedge may be kept free of gaps with very little trouble; for that purpose it is, however, necessary, about the end of the first autumn after the hedge has been planted, to examine it carefully throughout its whole extent, take out such plants as are either in a decaying sickly state, or those that are actually dead, and fill up the spaces they occupied with the strongest and most vigorous ones that can be found; where this care is taken for the first two or three years, there will be no defects in the hedge, which will be uniformly thick and strong throughout. Thus far of young hedges; but when old hedges are meant to be cut down, that have many gaps or open spaces in them, so wide as to prevent the possibility of the young shoots filling them up, some expedient must be had recourse to, in order to render the fence complete. This purpose may, it is observed, be answered in different ways: the easiest and indeed the most common method is, for the hedger, when he comes to a place where any of the plants are wanting, to take one of the strongest plants next to it, and after giving it a gentle stroke with the hedge-bill, to bend it across the opening, and entwine it with the thorns on the opposite side: indeed, as has been already stated, some have a custom of cutting down only a fourth part of the stems, and warping the remainder with these, which appear like stakes driven into the earth. Where the hedge is shortened to within three or four feet of the ground, both of these methods answer pretty well; and the openings, which would otherwise have been left, are in some degree filled up: but when the old hedge is cut close to the earth, other methods of supplying the defects become necessary. One very simple, and at the same time very effectual mode, consists in first digging the ground pretty deep with a spade, and taking one of the strongest plants on each side of the opening, that have been purposely left uncut, removing the earth from their roots so much as to loosen them, and admit of their being bent down, and laid close to the earth in the opening, as represented at *fig.* 12; they should then be fastened down with wooden hooks or pins, and entirely covered throughout the whole of their length with earth. Where this is properly executed, the plants so laid down send up a great number of young shoots, which very soon fill up the vacancy: where it is practised upon a hedge that is cut over close by the surface, no other care is requisite; but when it is done with hedges that are cut at three or four feet above it, there will be a necessity for placing a temporary paling in the gap, to protect the young shoots from injury till they acquire a sufficient degree of strength," as represented in *pl.* XL. *fig.* 1.

It is remarked, that there is scarce any thing attempted by farmers in which they are so unsuccessful as in the mending of hedges; in some cases the

defect is attempted to be supplied with young plants, which from want of attention very seldom succeed, as they are not only shaded by the strong old plants on each side, but are also deprived of their nourishment, by their roots spreading into the vacant space. To render an attempt to mend the defects of an old hedge with young plants successful, two things are absolutely necessary: the first is, that the whole of the roots of the old plants, which extend themselves into the opening, be entirely cut off; the next, that the hedge shall be cut down close to the earth, for at least a yard or more on each side of it. By cutting away the roots which extend themselves into the opening, the young plants are prevented from being robbed of their nourishment; and cutting down the old ones, for a little distance on each side, keeps them from being shaded, and allows them to enjoy the full benefit of the light and air: cutting down so much of the old hedge, no doubt, renders the opening larger, and of course requires more paling to supply the defect; but this extra expense will be more than compensated by the success with which it will be attended. In many instances, these vacancies are filled up with dead wood: indeed it is a common practice, after a hedge is dressed, to cram the greatest part of the prunings into these spaces, and under the bottom of the hedge, where it is any way open or naked. The most perverse imagination, it is said, could hardly suppose any thing more absurd; for, if it is the wish of the owner that the plants on each side should send out new branches to fill up the openings, the purpose is completely defeated by cramming them full of dead brush-wood, which not only prevents the extension of the branches, but, from the violence and injury that is committed in thrusting in dead thorns, the plants are often materially hurt; and when this brush-wood decays, the opening, in place of being diminished, is considerably enlarged; the mischief is the same where they are thrust under the hedge, the practice of which, when continued, never fails to render it naked at bottom. The use of stones for mending hedges is equally absurd and pernicious: where dead wood is used in the way above mentioned, the hedge, instead of being improved, is made worse. The utmost that can be said of stones is, that though they do no additional harm, the hedge is not bettered by them; and from the opening being filled up in that way, the defect is perpetuated, and both the usefulness and beauty of the fence are impaired. In some instances, where the attempt has been made, the defects of grown-up hedges have been very completely, and indeed almost immediately repaired, by planting strong beeches in the openings; these should be at least six or seven feet in height, and should be supported by a couple of pieces of coarse paling, put across the opening. If planted early in the winter, they suffer no check whatever, and grow so vigorously in the spring, as to fill up the vacancy the first season," as represented at *fig.* 2.

The ground in this, as indeed in every other case where young plants are used, should be well dug, and enriched either with dung or compost; the plants should be the healthiest and strongest that can be procured, and the whole of their roots as carefully preserved as possible.

In regard to the diseases of hedge-plants, it is stated, that "the principal one to which they (especially thorns) are liable, is being covered with moss; which, when it arrives at any considerable height, gradually destroys them. Upon certain soils, such as till, or cold wet clay, it is remarked, every description of woody plants are subject to this malady; and as it is evidently owing to the nature of the soil, it becomes a matter of importance to be able to apply a proper remedy. Lime is well known to be unfriendly to the growth of every description of moss, and in every instance where it is applied the moss disappears. This circumstance once known furnishes a cheap and effectual remedy, both for preventing the disease upon young hedges, and curing it upon such as are grown up. If the hints formerly thrown out, with regard to the preparation of the soil before a young hedge is planted, are properly attended to, and a sufficient quantity of lime incorporated with the earth, let the proper quality of the soil be what it may, its nature will be so much altered, as effectually to secure the hedge from every risk of being hurt by moss. The same remedy may be applied with equal success to old hedges, that are over-run with this vegetable vermin; and in which, though there may be plants enough in the ground, yet they are of no value, from the want of branches. To recover such hedges, and render them afterwards good fences, they should be cut down close by the surface, cleared completely of weeds, and the earth well dug for at least half a yard on each side of the roots. After this operation, which should be done about the end of autumn, the spaces so dug should be well limed upon the surface; it should be suffered to remain in that state during the winter, and early in the spring dug again, and the lime pointed in and incorporated with the soil. In the cases where this has been done, the plants have sent out a number of useful vigorous shoots, which soon made good hedges, and no moss has afterwards appeared. It is, from these experiments, to be presumed, and he hopes experience will confirm the idea, that in every case where either trees or hedge-plants are infested with moss, the use of lime, in the way pointed out, will prove a sufficient remedy for the evil. Before quitting the subject of hedges, he begs leave to mention the practice of many of the English counties, where it is common, after the plants have attained the wished-for height, to cut their stems about half through, within a few inches of the bottom; then bend them a little down, all in one direction, and bind them together at top, with willows, as represented at *fig.* 3. This, when properly executed, forms, he says, a very pretty neat-looking fence, but is liable to several objections. In cutting the plants so near the root, unless great pains are taken, there is a chance of cutting them too much; indeed, in some instances, they are cut through altogether; the value of the hedge is by

that means lessened, and gaps appear in many parts of it. The binding at top, being of dead wood, soon decays; and the plants either rise up, if they have not been very much cut, or, if the cutting has been deep, they are apt to be blown to one side, and even broke over by the wind. Owing to these causes, many hedges, where the plants are sufficiently numerous and healthy, and which with little trouble would have formed beautiful and useful fences in a short time, have their value impaired, and are rendered faulty and defective. Cutting the stems too much subjects them to another evil, namely, the mischief arising from heavy falls of snow, by which, when the quantity is considerable, especially if there is a high wind to accumulate it about the hedge, it is thereby pressed down, and many of the plants break entirely over. The practice formerly noticed, of cutting one-third of the stems over, at the height of about four feet from the surface, leaving those at standards, and warping them with the others that have been left of the full length, makes a much stronger fence, and one that is less liable to injury, either from the attempts of cattle, or from the wind, or heavy falls of snow. What adds to its value is, that the warping and binding of the bushes, being done with live wood in place of decaying, as is the case when willows or hazels are made use of, grow stronger with time, and the plants are in the end so completely interwoven as to form a fence which nothing can exceed either for closeness or durability. The way in which this operation is commonly done, is liable to one objection, however, it being customary to trim away the whole of the branches before the stems are bent down: this renders it no doubt a much easier business for the workman; but it materially injures the hedge, leaves it thin and open in many places, and gives it not only an unpleasant appearance to the eye, but makes it less useful as a fence. This defect is not in general repaired for a year or two; whereas, by leaving as many of the side shoots as possible upon that part of the plants that are to be laid horizontal, and, after the whole hedge is warped, trimming it neatly with a hedge-bill, it will form at once a solid and useful sort of fence." Hedges done in this way are represented at *figs.* 10 and 11, in *pl.* XXXIX.

The work of plashing, according to Mr. Young, is done in the following manner: "the men first clear the old hedge of all the dead wood, brambles, and other irregular growing rubbish, leaving along the top of the bank the straightest and best-growing stems of thorn, hazel, elm, oak, ash, sallow, beech, &c. about five or six in a yard; but, if there are any gaps or places thin of live-wood, on each side of such places, they leave the more. When this work is done, they repair the ditch, which, he says, he should never advise to be less than three feet by two and a half, and six inches wide at bottom, in the driest soils; but in all wet or moist ones, never less than four by three, and one at bottom. All the earth that arises from the ditch is to be thrown on the bank. The men, if no bargain is made with them before-hand, will, he says, lay some of it on the brow of the ditch; but this must not be allowed, unless the ditch-earth happens to be extraordinarily rich, and to pay well for carrying it to the land, otherwise the grass of the border is spoiled, and the farmer is at the expense of carting earth which may be worth but little." And, "when the ditch is finished, the men, he says, begin the hedge. Such of the stems left in cutting the old hedge, as they find growing in the line where the new hedge is to run, they cut off three feet from the top of the bank, to serve for hedge-stakes to the new hedge. This practice cannot be too much commended; for these stakes being immoveable, and never rotting, keep up the new hedge, so that it never falls or leans either way. In the next place, they drive in their dead hedge-stakes where wanted, chusing sallows or willows, that they may grow. The hedgers then plash down the remainder of the live wood left standing. They cut the stick twice, one stroke near the ground, and the other about 10 or 12 inches higher, and just deep enough to slit out a part of the wood between the two, leaving the stem supported by little more than the bark, or about a quarter of its first size. It is then laid along the top of the bank, and weaved among the hedge-stakes. All are served thus; and, where they are not thick enough to finish the hedge, dead thorns are wove among them: then the top of the hedge is eddered in the common manner" for other sorts of hedges.

It is remarked in the Shropshire Report, that this "is a business which requires great nicety and judgment, and which has the most ignorant operator to perform it in general; who, in the first place, cuts downwards through mere idleness, instead of upwards, and so exposes the heart of the plant to the weather. In the few places where hedges are well plashed, it is done with as much care as a fruit-tree is trained to a wall, and, in its way, perhaps with as much judgment." And it is advised, that "the quicksets should not be cut in this way,

but in this:

It is added by Mr. Young, that "the fence thus made, consists of a good ditch and a hedge, most parts of which are alive; that is, the stakes, and much of the wood that is weaved between them. The importance of having as much as possible of the hedge alive, cannot, he thinks, be too strongly impressed." He conceives that "this management

ensures a lasting fence; whereas, the hedges that are all dead, presently rot, and fall into the ditch. Those farmers, who live in countries that know nothing of the plashing method, cannot, he says, give too much attention to teaching it to their men. The best way is, he supposes, to send for labourers from the plashing countries, who, in one season, will easily instruct their regular men in the business, which they may afterwards perform without difficulty," and in a perfect manner, which cannot be done in any other mode.

It is observed, that it should never be forgot that in every operation of this kind, where old hedges are either cut over or bent down, the ground on each side, as soon as circumstances will admit of it, be completely dug, cleared of weeds, and the earth laid up to the roots of the plants. It is truly surprising, he says, what numerous and luxuriant shoots the stumps send out, when managed in this way: while, on the contrary, when these necessary operations are neglected, fewer shoots proceed from the old trunks; and, of these few, a considerable proportion are choaked and destroyed by the weeds and other rubbish in the bottom of the hedge.

Compound Hedge-Fences.—*Single Hedge and Ditch, with or without Paling.* This is a kind of fence in which the ditch is of different dimensions, according to circumstances; the thorns are for the most part, Mr. Somerville observes, placed upon the common surface, upon what is termed a scarcement, or projection of six or seven inches, on which they lean, and which serves as a kind of bed, when they are cleaned. By placing the plants thus far back from the edge of the ditch, they are in a great measure secured against the accidents to which they would otherwise be liable, if they were placed immediately in the front of the bank; as there are few ditches, however carefully they may have been made, into which the earth does not afterwards slide and fall in. In cases, therefore, where the thorns are planted immediately in the face, or what is termed the brow of the ditch, if any portion of the earth falls in, it either carries the plants along with it, or deprives them of their nourishment; whereas, by placing them at the distance of six or eight inches back from the front, there is no risk whatever of their being injured by the earth falling down. It appears also, he says, that the space commonly allowed for a scarcement is by far too little, being seldom more than four inches. In place of which, it ought, he thinks, never to be less than twelve or fourteen inches. This would have several advantages, as it would not only prevent all risk of the earth tumbling in, and bringing the plants along with it, but would at the same time afford ample room for weeding the hedge completely, and drawing up the earth to the roots of the plants. These are matters of considerable importance, and which, along with their destroying weeds, promote the growth of the hedge, by affording sufficient pasture for the plants, and enabling them to resist the effects of drought, frost, &c. much more completely than they would have been able to do, if planted directly in the face of the ditch. It is common, he says, to lay the hedge-plants upon the plain surface, without any preparation whatever. But, in other cases, the first spadeful that is taken out of the ditch is laid on the front, and the plants placed above it: whatever the soil or situation may be, it is of importance to place the plants upon a bed of good, rich, well prepared earth, capable of affording them not only a due degree of nourishment, but into which their roots may strike with the utmost ease. Upon a very dry soil, and in elevated situations, it is sometimes necessary to place the hedge-plants considerably below the common surface, to prevent them from suffering by drought: where this is practised, the ditch is first dug of the ordinary dimensions, and the earth that is taken out of it laid about twenty inches back from the edge; the labourer then, with a spade, cuts down a space about fifteen inches broad, and ten or twelve inches deep, along the whole front of the ditch; this space, when cut, resembles a shelf: an inch or two of the best mould, well broke and pulverised with the spade, is laid upon this shelf or scarcement, upon which the plants are laid, not exactly in a horizontal direction, but with the tops a few degrees higher than the roots. The earth taken out in forming the shelf is then replaced above the roots, in such a manner as to form a good slope from the front of the ditch backwards: and where the soil is deep enough to admit of this being properly done, there are few situations, however dry, where the hedge will run any risk of suffering from too much dry weather.

It is farther remarked, that in very cold wet situations, this practice is reversed; and in place of planting the hedge upon or below the common surface, it is found necessary to raise it considerably higher: for that purpose, the first two spadings or spits taking out of the ditch, and which always consist of the best earth, are laid about ten inches back from the front; this, when properly done, forms a bed of from twelve to fifteen inches in thickness, upon which the plants are laid; the roots are then covered with the remainder of the best earth, and the bank formed in the ordinary way. Where the hedge is either white-thorn, crab, or beech, the precaution of raising it above the common surface is, he says, essential to its welfare upon cold or wet soils; and, in many of these situations, good hedges are made in that way, that could not possibly have been done by any other means. It must be admitted, however, he says, that by raising it so much above the common surface, the pasture of the plants is in a great measure confined to the bank formed by the earth taken out of the ditch; and in many instances, when the winters are severe, and much black frost happens, it penetrates the bank so completely, as entirely to destroy the hedge. In all cases where hedges are to be made either in this or any other way, the soil, so far as circumstances will admit, ought, he thinks, to be cleaned, pulverised, and enriched with lime, compost, or other

manures; which will not only enable them to push away vigorously, but at the same time prevent, in a great measure, the distempers of moss or cankering, to which hedges upon stiff clays or cold wet soils are very liable to be affected with.

When speaking of the simple ditch, notice was taken of the necessity of giving it a proper slope, to prevent its tumbling in after frost, or being excavated by the run of the water. Where a hedge is added to the ditch, this precaution is, he says, equally essential, indeed more so, as the injury done to a simple ditch can be repaired with the spade at little or no expense; whereas, when a hedge is planted in the front, any considerable portion of the earth falling down brings the plants along with it, and makes a breach in the hedge, which no industry will afterwards be able to remedy. To keep them pretty broad at top, and gradually tapering towards a point at bottom, ought to be a constant and invariable rule: ditches so constructed are seldom, if ever, undermined, and retain their shape for many years. Upon ditches so formed, from their containing little water at bottom, the greatest pressure and action of the fluid is upon the upper part, and upon that, from the nature of the slope, its effects are lost. Those, who have made sufficient observations, know, that in every instance where water acts upon a perpendicular surface (especially if the soil is of a soft incoherent nature), its force is greatest; whereas, when it operates upon a sloping bank, its face is short, and it does no injury. A knowledge of the laws of hydrostatics explains this. The pressure and operation of fluids is always in proportion to their altitude or perpendicular height. Upon a sloping bank this pressure is lost; and the more gradual the slope, the less effect the water has. It is owing to this circumstance, that the low sloping parts, both upon the banks of rivers, and on the sea-coast, continue unaltered for many ages, while the high bold parts of the shore, unless they are entirely of rock, are continually tumbling down. The same thing holds good in regard to ditches: whatever the height of the column of water may be in the middle, or however rapid the current, the narrowness of the ditch at bottom, and its sloping gradually upwards, divides and diminishes the force so completely, that it is scarce felt upon any part of it; whereas, when the ditch is wall-sided, and of one uniform width from top to bottom, the water, by being confined almost entirely to the under part, runs away the soil, and excavates and undermines the sides of the ditch, which occasions their breaking down.

Where the purposes of the proprietor or occupier require that the fields recently inclosed with ditch and hedge should be made fencible at once, it is very common either to surround them with a paling placed upon the top of the bank, formed by the earth taken out of the ditch, or with a wall of coarse loose stones, in the form of a *Galloway-dike*, placed also upon the top of the bank. Where stones are plenty, this last forms an excellent fence for the purpose of confining the cattle, and is at the same time a good shelter for the hedge. *Fig.* 4. *pl.* XL. represents a young hedge protected by an open wall of this kind.

In cases where a paling is placed upon the top of the bank, it is made of different materials, according to the circumstances of the case; in some situations it is made of slabs, in others of laths, the prunings of fir-plantations, &c.; in all of which, when properly executed, it not only answers the purpose of a temporary fence, but at the same times serves as a complete protection to the young hedge from the depredations of sheep and other sorts of animals.

Hedge and Bank. It is a kind of fence that consists of a hedge planted upon the plain surface, with a bank or mound of earth raised behind it by way of protection. A very good idea of this fence may be formed from the figure. This bank, in some instances, is faced with sod on both sides, sloping gradually towards the top; while in others, and indeed by far the greatest number, it is only faced on one side, which is nearly perpendicular, and has a gradual slope on the other, similar to the bank made with the earth, taken out of an ordinary ditch. The hedge is frequently planted at the bottom of the perpendicular side, that is faced with sod; but in many cases it is planted on the other side, near the bottom of the sloping bank of earth. The last is, he thinks, certainly the best situation for the hedge; for if the earth with which the bank is made has been taken, as it generally is, from the side that is faced with sod, this facing will form a kind of sunk-fence, the bottom of which will be considerably below the common surface; of course, any hedge planted in such a situation will not only be put into the worst of the soil, but will at the same time be in danger of perishing from the moisture lodging there, and chilling the roots; whereas, when it is planted on the other side, near the bottom of the slope, the plants have the best of the soil to strike into, and are in a great measure secured against the bad effects of stagnant moisture.

It is remarked, that, in bleak exposed situations, where hedges cannot be successfully reared without shelter of some kind or other, the bank of earth is a good contrivance, as it screens the young plants from the inclemency of the weather, till they acquire a degree of strength sufficient to enable them to resit the rigour of the climate, which it is now well known many plants are able to do after they arrive at a certain age and strength, that would have been completely killed, had they been exposed in the same situation, and without shelter, at any earlier period. In such cases, therefore, earthen mounds similar to what has been described, or stone walls, are essential to the rearing of good hedges, especially of white-thorn. But as this fence, like the common turf wall, cannot be erected without a considerable destruction of the adjoining surface, it should never be used but in cases of the strongest necessity. The only instance in which it can be made without any loss, is upon the sides of highways, where the road is not bounded by a ditch, but slopes gently to each side; in that case a sufficiency of turf and earth for facing and forming the bank may be had from the

side of the road. This will have a double advantage; the earth, if taken from the road with judgment, and in such a way as to form a gradual slope from the middle towards the sides, will produce two very considerable advantages; the slope will keep the road perfectly dry, and the earth taken from it will, with the assistance of a slight paling, completely inclose the field, and serve as a protection to the young hedge. It is worthy of remark, that, when the hedge is planted behind the bank, the paling should not be upon the top, as is commonly the case, but on the side next the field, to serve as a protection against the cattle grazing in it: when it is next the road, however, the paling may be placed upon the top, in which case it will render the fence more inaccessible and secure. See *figs.* 3. and 4.

Hedge in the Face of a Bank. This is a kind of fence that differs from the former, principally in having the hedge in the front of the bank considerably above the common surface, in place of having it at the bottom, as already described. The work is executed in the following manner: the bank faced with sod on one side, and having a gradual slope on the other, is raised to the height of eighteen inches, or two feet; the top is then levelled, and covered with two inches of good earth, above in which the plants are laid horizontally, with their tops projecting about a couple of inches over the edge of the bank; the roots are afterwards covered with the same mould, and the bank raised to the desired height. This fence is greatly inferior to that already described, as the hedge-plants, by being raised so much above the common surface, are liable to great injury, not only from the bank decaying and mouldering down, and by that means depriving them of their nourishment and support, but also from the effects of frost, drought, &c. In many instances, however, it may be useful, especially in the inclosing of wet lands, where hedges would not thrive, if placed upon the common surface; but in such cases it is worth while to notice, that great advantage will arise from placing the hedge-plants about eight or ten inches back from the front, upon a sort of scarcement similar to what is done in the common ditches. When planted in this way, there is little or no risk of the bank mouldering down; and the shelf or scarcement left admits of the hedge being completely cleaned, and the earth drawn up to the roots of the plants—circumstances of importance in the growth of the hedge. It is represented at *fig.* 5. *pl.* XI.

Another description of hedge and bank, which is met with principally by the sides of high-ways, in situations where the ground has a sudden declivity towards the road, is, that in these cases it is common to cut down the face of the bank, in a sloping direction, to within eighteen or twenty inches of the bottom, where a bed is made of about two feet in breadth, covered with good earth broken very small; upon this the plants are laid, with their extremities about nine inches from the front; the roots are then covered with eight or nine inches of good mould; the bed below with the projection in this case serves the same purpose as the scarcement of the common ditch, and affords complete room for cleaning and drawing up the earth to the roots of the hedge. In the construction of this fence, it is essential to give the face of the bank such a slope, as to prevent the earth from tumbling down; if this is neglected, it will be continually falling in large masses after every frost, or fall of snow or rain. It is sometimes the practice, however, instead of planting the hedge, within eighteen inches of the bottom, as here described, to slope the bank first in such a way as to insure it against tumbling down, and plant the hedge upon the top, at the distance of about a foot and a half from the verge of the bank. A hedge planted in this way, when it thrives, will certainly look much more formidable than one planted at the bottom; but it will be liable to more accidents than the other, from drought, frost, and the falling in of the bank. It is shown at *fig.* 6.

Hedge and Bank, or Hedge on the Top of a Bank. This is a sort of fence common in many parts of England, and also in some parts of Scotland, and consists of a high bank of earth taken from the adjoining ground, pretty broad at bottom, and tapering gradually towards the top, upon which the hedge is planted. It is however to be objected to on account of the great waste of soil, the want of moisture, and its predisposition to the production of moss. It is seen at *fig.* 7.

Devonshire Fence. This is a sort of hedge and bank, as it consists of an earthen mound, seven feet wide at bottom, five feet in height, and four feet broad at top, upon the middle of which a row of quicks is planted; and on each side, at two feet distance, a row of willow-stakes, of about an inch in diameter each, and from eighteen inches to two feet long, are stuck in, sloping a little outwards; these stakes soon take root, and form a kind of live-fence for the preservation of the quicks in the middle. This fence nearly resembles the hedge on the top of a bank, and is equally expensive in the erection: the formation of the bank deprives the adjoining surface of its best soil, and the plants made use of are liable to every injury that can possibly arise from drought, frost, and the gradual decay or crumbling down of the mound. The addition of the willows to this fence is certainly a disadvantage; if the quicks require protection, dead wood is equal to every purpose that could be wished or expected; and at the same time possesses the additional advantage of requiring no nourishment, and having no foliage to shade the quicks, or other plants. It is shown at *fig.* 8.

Hedge with Post and Rails. This is also a sort of fence sometimes employed; the railings being frequently employed for the protection of hedges, as well those that are planted upon the plain surface, as for the hedge and ditch united. The addition of a paling is, however, more immediately necessary in cases where the hedge is planted upon the plain surface, especially when the fields so inclosed are in pasture. If only one field is inclosed in this way, and the adjacent lands are under a corn-crop, a

single railing on the inside of the inclosed field will be quite sufficient for its protection; but when the adjacent fields are also under pasture, a double railing becomes necessary, or, in other words, a railing placed on each side of the young hedge, at a sufficient distance to prevent the sheep or cattle from cropping it: without such protection, the hedge-plants are not only liable to cropping, but also to being trodden and destroyed by their feet; an injury which, when it happens at an early period of their growth, the plants continue low and stunted ever afterwards. It is seen at *fig.* 9.

Hedge and Dead Hedge. This is a fence that consists of a row of quicks or other hedge-plants, set either upon the plain surface, or in the face of a ditch or bank. The dead hedge answers a double purpose, namely, that of protecting the young plants from the injuries they may receive from cattle, or the inclemency of the weather; and at the same time forming a temporary inclosure, which lasts till the hedge is grown up. Where dead hedges are made of proper materials, such as the cuttings of thorn-hedges, &c. and are well let into the ground, they answer these purposes very completely, and should always be used for the protection of young hedges, where the materials can be obtained at an easy rate. It is worthy of notice, however, that in every instance where dead hedges are used for the protection of live ones, in place of cramming them close together, as is commonly done, there should be a distance of at least three feet between them. In that way the hedge-plants will have room to grow and spread out their lateral branches at bottom, a thing essentially requisite to the formation of a good hedge, while an opportunity will at the same time be afforded of weeding the hedge, and loosening the earth completely on both sides of the plants. It is represented at *fig.* 10.

Hedge and Wall Fence. This is of two kinds, one of which will be afterwards described, namely, a coarse open wall, made of loose stones, resembling a Galloway dike, made upon the top of the bank formed by the earth taken out of the ditch. The second is chiefly used when hedges are planted upon the plain surface; in which case the wall, though thin and low, is regularly built, and answers the double purpose of sheltering and encouraging the growth of the plants while they are in a weak tender state, and afterwards prevents the possibility of the hedge becoming open below, where gardens are entirely, or in part, surrounded by hedges; and in the inclosing of fields by the sides of highways, especially in the vicinity of great towns, where dogs and other destructive vermin are apt to creep into the inclosures, and annoy the stock, the low wall forms a valuable addition to the fence. It is customary in some cases, after the hedge has attained a certain height, and is thought to be out of danger, either to remove the wall entirely, or allow it to decay. "This, Mr. Sommerville says, is certainly a bad practice, as it not only leaves the bottom of the hedge naked and open, but at the same time deprives the roots of the plants of a protection to which they have been accustomed, and the removal of which operates as a severe check to their growth. In every instance where the wall is intended to be removed, care should be taken to cover the roots of the plants that are left exposed with good earth; by that means they will be prevented from being hurt by exposure to the weather, and they will suffer little, if any, check. It frequently happens, however, to the utter disgrace of the proprietor, that the wall is removed, and the roots of the plants left naked, and exposed to every injury. In such cases, if the hedge has been planted a little above the common surface, as soon as the wall is removed, the earth begins to moulder and fall down, and continues to do so till the plants, deprived of their support, tumble down also, and the hedge is by that means entirely ruined." It is seen at *fig.* 11.

It is remarked, that "there is another description of hedge and wall which properly comes under consideration in this place; that is, when the hedge is planted upon the top of the wall: this differs from a hedge on the top of a bank, already described, only in one particular, which is, that of the bank being faced with stones, instead of sod or earth. When such a fence is attempted in a level country, the wall must be very broad, not less than four or five feet, and the middle of it filled with earth; in short, the construction should be nearly the same as the Devonshire fence already described, only the facing on each side to consist of stones in place of turf. The objections made to the Devonshire fence apply with equal propriety to this, being expensive in the erection, troublesome to keep in repair, and in its nature by no means durable."

There is still another kind of this fence, which, it is observed, in particular situations is extremely useful; that is, "where the land has a considerable declivity, which terminates abruptly on the side of a highway, or an inclosure running along the side of high grounds, that leans very much to that side where the fence is intended to be made. This is commonly executed with a perpendicular front, and without any contrivance for carrying off the moisture; in consequence of which, after bad winters, or long continued rains, the earth swells, the wall bursts, and is thrown down: when the wall is of dry stone, there is, however, little risk of this accident happening, as its open texture readily admits of the moisture passing through it; but when the wall consists of stone and lime, stone and clay, or any other substance that prevents the discharge of the moisture, the earth, as already mentioned, swells, and the wall bursts, and is thereby destroyed. In order to render a facing of this sort durable, it is requisite—if the wall is built with stone and lime, or a mixture of clay, turf, or any other materials that resist the passage of water through them—instead of building it perpendicular, as is commonly done, to give it an inclination of some degrees backward, and to have openings at the bottom, at regular distances from each other, for discharging the moisture that may issue from the bank. And in order to render these openings as completely useful as possible, it

should have a space at the back of the wall, and immediately at the bottom, of about twelve inches broad, and the same depth, filled with small round stones; these, by serving as a kind of drain, will receive the moisture that soaks down, and afford it a ready passage by the openings that have been mentioned." It is shown at *fig.* 12.

Hedge in the Middle, or in the Face of a Wall. This is a sort of fence somewhat like that last described, but which can only be made in the face of a bank where the land rises immediately behind it: the practice, Mr. Sommerville observes, "is new, ingenious, and deserving of attention. It is executed in the following manner:—the face of the bank is first cut down with a spade, not quite perpendicular, but nearly so; a facing of stone is then begun at the bottom, and carried up regularly, in the manner that stone-walls are generally built: when it is raised about eighteen inches, or two feet high, according to circumstances, the space between the wall and the bank is filled up with good earth, well broken and mixed with lime or compost: the thorns are laid upon this earth in such a manner, as that at least four inches of the root and stem shall rest upon the earth, and the extremity of the top shall project beyond the wall. When the plants are thus regularly laid, the roots are covered with earth, and the building of the wall continued upwards, filling up the space between the wall and the bank gradually, as the wall advances upwards: when completed, the wall is finished with a coping of sod, or stone and lime. When the plants begin to vegetate, the young shoots appear in the face of the wall, rising in a perpendicular manner." It is seen at *fig.* 1. *pl.* XLI.

It is remarked, that "Sir James Hall, of Dunglass, has adopted this mode of inclosing pretty extensively upon his estates in East Lothian, and is the first who introduced that plan on the east coast from Gallom. The appearance is at once new and handsome; the whole seems to be in a very thriving condition, and in several parts the hedges have made great progress. Most of them, however, being young, no decisive opinion can, he thinks, be formed as to the real advantages or defects with which this mode of inclosing may be attended. Apparently, it is liable to several objections. In the first place, if from weakness, or other accidents, any of the plants should sicken or die—a circumstance by no means uncommon, even where every possible care has been taken to select the stoutest and best— the defect thereby occasioned cannot be repaired without taking down the wall, at least as far as the place where the hedge was laid; this will be found highly expensive and inconvenient; the inconvenience would however be less sensibly felt, if the failure of the plants happened only in one part of the wall; but when, as will always be the case, the plants misgive in many different places, it will be found a very expensive and arduous business, to take down and rebuild the wall in every place where two, three, or more thorns have failed. Were this labour and expense repaid by any extraordinary advantages, the practice might derive additional strength therefrom; that, however, is far from being the case; for, though the plants in a hedge of this sort are, from the great quantity of earth laid upon their roots, less liable to injury from drought, frost, &c. they are at the same time further removed from the genial influence of the sun and the air.

Hedge and Ditch, with Row of Trees. This fence differs from those which have been described only in having a row of trees planted in the line of the fence along with the hedge.

The advocates for this practice say, that, by planting hedge rows of trees in the direction of the fence, the country is at once sheltered, beautified, and improved; and that the interest of the proprietor is ultimately promoted by the increasing value of the timber raised in these hedge-rows. It is also said, that such trees produce more branches for stack-wood, knees for ship-builders, and bark for the tanners; and they sell at a higher price per load than trees grown in woods and groves. Besides, close-pruning hedge-row trees, to the height of twelve or fifteen feet, prevents their damaging the hedge; the shelter which they afford is favourable to the vegetation both of grass and corn; it also tends to produce an equable temperature in the climate, which is favourable both to the production of and greater perfection and beauty in animals, and of longevity to man. Though the practice of planting hedge-rows of trees is very common (especially in England), though its advocates are numerous, and though these arguments are urged in its favour, yet the objections are also entitled to very serious consideration. "When trees are planted in the line of a fence, if that fence is a hedge, the plants of which it consists will, Mr. Sommerville says, not only be deprived of a great part of their nourishment by the trees, but will also be greatly injured by the shade they occasion, and the weight of the drop that falls from them during wet weather: upon this point little reasoning is necessary; for, if we appeal to facts, we shall find that no good hedge is to be met with where there is a hedge-row of trees planted along with it. The mischief is not however confined solely to hedges; the effects are equally bad, perhaps worse, where the fence is a stone wall; for though in this case the shade or drop of the trees are hardly if at all felt, yet, when they have attained a certain height, the working and straining of the roots during high winds is such, that the foundations of the wall are shaken and destroyed; accordingly, wherever large trees are found growing near stone walls, the fence is cracked and shaken by every gale of wind, is perpetually falling into large gaps, and costs ten times the expense to keep it in repair, that would otherwise be required if no trees were near it. Admitting, however, that the trees in hedge-rows were no way prejudicial to the fence, which we have already shown is by no means the case, another argument may be successfully used against the practice. It is seldom, indeed, that trees planted in hedge-rows arrive at any great size; on the contrary, they are generally low and stunted:

and while they occasion a visible loss by the mischief they do the fence, their utmost worth, when they come to be sold, will seldom be found adequate to the loss and inconvenience they have occasioned. This is very satisfactorily accounted for from the want of shelter; trees planted in hedge-rows being exposed to every inclement blast; by that means they are deprived of what is very essential to promote their growth, and which is in fact the cause why trees in large plantations thrive better than when they are planted singly; namely, the mutual shelter which they afford to each other; it being observed that all trees on the skirts of plantations are much lower than those more removed from the extremity; this is owing to their bearing the first gust of the wind, which after being once broke, its violence is gradually abated, and in proportion as the trees recede from the verge of the plantations, they feel it less, and rise to a larger size."

It is further observed, that "hedge-rows of trees are in a still more unprotected situation than those which form the skirts of a plantation, the latter being exposed to the violence of the wind only when it blows in one direction; this is what is generally termed the prevailing wind; when the gale is from any other quarter they can hardly be said to feel it; whereas, hedge-rows are exposed to the ravages of every blast, in whatever direction it may blow. There are, no doubt, some favoured spots where not only hedge-rows, but even single trees, may thrive, and attain a great size, without any protection whatever; the cases in which this happens are however but few, and can in no sense be quoted in support of the general practice of planting trees in this manner." It is represented at *figs.* 2 and 3.

Hedge and Ditch, or Hedge and Wall, with Belt of Planting. This fence in exposed situations is strikingly useful and ornamental, while upon the low grounds it is not only unnecessary, but in some instances absolutely hurtful. "For instance, in deep and broad valleys surrounded by hills, and sheltered from severe blasts, belts of planting are not only unnecessary, but even hurtful and ruinous by the ground they occupy, which could certainly be employed to greater advantage, and the original expense of inclosing and planting saved. There are many instances both in Scotland and England of low, flat, rich lands, being inclosed, and completely protected from the inclemency of the weather, without any aid whatever from this fence. There are other situations, however, where, though the lands are very flat, and the soil good, yet, from the want of hills and high grounds in the neighbourhood, they are so much exposed to the sea blasts, and a current of air, passing over a great extent of country without any interruption, that the value of the soil is thereby very much diminished. The peninsula which forms the county of Caithness is a striking proof of this: with a soil of a very good quality, and highly improveable, its value is greatly impaired by the circumstance of its being so much exposed to sea winds, which, coming from a very inauspicious quarter, and blowing over a considerable extent of country without meeting with any obstacle to break the force, or change their direction, blow with uncommon severity and fierceness, and in that way are an effectual check to vegetation. There are very extensive tracts in England in nearly the same situation, the whole of which might at small expense be sheltered, and rendered completely productive, by intersecting the country in a judicious manner with plantations and hedges, either separately or conjoined, as in the hedge and belt of planting. In the formation of it, considerable pains and attention will be found necessary. In every case where it is meant that the hedge and belt of planting shall constitute a durable and efficient fence, it must be made of a certain breadth; from forty to sixty feet is the very least breadth that should be allowed; and in cases where the situation is very elevated, and the intrinsic value of the soil small, the belts should be three times that breadth: such a space will allow abundant room for planting such a number of trees as will, by the mutual shelter which they afford to each other, promote their growth, and protect them against the blasts which are so severely felt in those elevated regions. The more effectually to promote the desirable purpose of sheltering the young trees, they should be planted very thick; perhaps four or five times the number that is meant to be allowed to grow to the full size should be planted. The expense of the plants in the first instance will be very trifling, and much more than repaid by the value of the weedings, after they have attained a certain age; with this additional benefit, that the whole plantation will grow faster, and in that way sooner answer the purpose of sheltering the lands. Planting an extra number of trees is also beneficial in another point of view, namely, that of affording a choice of the most healthy plants to be left, when the plantation is thinned out." It is seen at *fig.* 4. See *Planting.*

It is remarked, that "the manner of protecting these belts is different in different situations; where wood is plenty, a simple paling, or ditch and paling, forms the fence; where stones are plenty, a wall is frequently made use of; but in by far the greatest number of cases, the ditch and hedge already described, or sunk-fence with a hedge upon the top, are adopted; or any of these, when properly executed, will answer this purpose extremely well; but as there are some of them better and more durable than others, and as permanence ought never to be lost sight of, either in this, or any other mode of inclosing, it is of consequence to fix upon that which unites immediate use with durability. The stone wall, sunk fence, and ditch and hedge, are certainly the most durable; the two first are indeed complete at once, and every benefit that can be derived from their use is immediately obtained; the hedge and ditch, on the other hand, rises by very slow degrees, during which the belts are exposed both to the weather and the injuries arising from sheep and cattle breaking into and trampling upon

the young trees; after all, it is very seldom that a hedge which surrounds a belt of planting forms a good or useful fence."

Hedge and Ditch, or Wall, with the Corners planted. This mode is employed upon some estates instead of the belt of planting. "Upon an extensive property, and where the fields are not very large, this mode of inclosing has a good effect upon the scenery of the country, and answers the purpose of general shelter extremely well. It certainly has a more pleasing and natural appearance to the eye than the stiff formal look of a number of straight belts running in parallel lines; it is, however, greatly inferior to the belt of planting, for the purpose of sheltering particular fields. But as in every field there is a space in each angle that cannot be ploughed, by planting these spaces, which would otherwise be left waste, the country is thereby ornamented, and many valuable trees raised with little expense, and with scarce any waste of land." This plan is particularly recommended by Dr. Falconer, in the Staffordshire Report, in the following words. "In every act for an inclosure, let there be a clause obliging the proprietor of the new inclosed land to plant a certain number of oaks, in proportion to his share of the inclosure, and directing the plantations to be made in the angles of the fields; by adopting which plan, a less quantity of posts and rails would be required, and the angles of each field would be converted to a profitable use, and corn would grow close up to the rails: whereas no corn will now grow in such angles. This is not the only advantage that would arise from this plan; the trees, full grown, would afford good shade for cattle, and an easy communication through these plantations would be from field to field. It would also be very ornamental to the country." Others, however, doubt the utility of this practice, as, in point of fact, the greater number of such corners are necessarily occupied by gateways, that could not, without considerable inconvenience, and increasing the farmer's labour, be made use of in any other way. This is seen at *fig.* 5.

Whin and Furze Fences. Hedges of this kind may be had recourse to with advantage whenever such plants are found to grow vigorously in a soil. Fences of this sort are mostly made upon mounds or banks of earth, by sowing the seed of the plant. Sometimes the bank is only sloped on one side, but at others on both; in the former case the front is perpendicular, and faced with turf or stone. From these fences being raised so considerably above the common surface, they are very liable to injury from frost and other causes in severe winters. Different fences of this sort are represented at *figs.* 6 and 7.

Paling FENCES.—In speaking of paling or timber fences in general, it is observed, by the same author, that, "in all permanent plans of inclosure, palings are only to be considered in a secondary light; for, of whatever wood they are made, however substantially they may be executed, or in whatever situation they are placed, their decay commences the instant they are erected. The slightest attention will, says he, be sufficient to convince every person of observation of this truth. Where permanent use therefore is required, palings ought never, he thinks, to be adopted; but for ornament in pleasure-grounds, or for the protection of young thorns, they are highly valuable. When the different kinds of paling come to be spoken of, notice will, he says, be taken of the mode of constructing each; but as there are certain circumstances which may be considered as common to all palings, this is judged the most proper place to mention them. In all cases where either dead hedges or palings are used, the decay and ultimate loss of the fence is owing to that part of it which is let into the ground being rotted by the moisture. Where dead hedges are planted, it is no easy matter to provide a remedy against this evil; as the stems are so numerous, that, to give each of them a preparation that would completely defend it from the effects of moisture, would be attended with an expense equal to, if not greater than the value of the fence. Where palings, however, are used, especially the most expensive and substantial kind of them, and such as are meant both for duration and ornament, it is desirable to prepare the standards, or upright parts that are placed in the earth, in such a manner as will enable them to resist the moisture for many years. In the South of England, the post is always more bulky at the lower end than the upper, and is fixed in the ground by digging a hole, placing it therein, shovelling the soil in, and ramming it round the post till it be firmly fixed. It has been, he says, a practice time immemorial, to *burn* or *char* that part of the standards or palings intended to be set or driven into the earth: the reason assigned for this practice was, that the fire hardened the parts thus subjected to it, and, by rendering them impervious to moisture, made them more durable than they would have been without such operation. But the best defence at present known against the effects of the weather is, he asserts, the bark of the tree. This covering it has from nature; and it is possessed of every requisite that is necessary, being impregnated with oil, rosin, and other matters, which secure it completely, not only against moisture, but other injuries arising from the operation of air, light, heat, &c.; of this we have strong proofs by observing what happens where the bark of any tree is destroyed, by cutting off a branch, or otherwise. If the surface laid bare by the wound is considerable, the body of the tree opposite to it begins immediately to decay, and continues to waste, unless some covering is made use of to supply the place of the bark; for that purpose nothing has yet been found so effectual as a coat either of boiled oil, or of oil-paint, which, by completely excluding both air and moisture, not only preserves the tree from rotting, but also prevents it from bleeding and wasting itself by an effusion of juices from the wound. When trees are cut down and sawn into planks, whether for palings or any other purpose, where they are afterwards to be exposed to the weather, the same thing happens that

we have mentioned as taking place with the growing tree when deprived of its bark, but in a much greater degree, as the whole surface is then without a covering. To prevent this decay, the same remedy should be applied, *viz.* painting the whole of the wood, or otherwise filling the pores with oil, in such a manner as to prevent the entrance of moisture. There are now coarse oil-paints sold of all colours, so cheap as to enable persons erecting palings, or other works of wood, to paint them at a small expense. Another very good remedy is to be had at a moderate price (lord Dundonald's coal varnish), into which, if the points of the standards that are to be drove into the earth are dipped while the varnish is boiling hot, it will preserve them from the bad effects of moisture for a very long time; previous to the dipping, they should be properly sharpened, and upon no account whatever charred or burnt, as every attempt of that kind will, upon inquiry, be found to injure the texture of the wood, and hasten its decay. This application, which has been found highly valuable for many purposes, and for which the noble discoverer is entitled to the gratitude of his country, has only one fault; namely, that it does not penetrate deep into the wood; and after being laid on a few months, is very apt to scale, and throw off with frost or the action of the sun: it has the farther disadvantage of hurting the appearance of the wood, and giving it an old, black, decayed look. Common tar, or melted pitch, may also be successfully employed for the purpose of defending the extremities of the upright parts of paling from moisture; linseed and train-oils may also be used with success; the great object being to fill the pores completely with some unctuous or greasy matter, so as to prevent the admission of moisture. The posts should be completely dry before they are dipped in any of these preparations; for if they are either made of green wood, or have imbibed much moisture; if, after being dipped they are exposed either to the heat of the sun, or a severe frost, the moisture will become so much expanded thereby, as to burst through, and bring off the coat of paint and varnish, &c.; whereas, when they are made of well-seasoned wood, and are at the same time perfectly dry, and the pitch, oil, varnish, &c. boiling hot, it readily enters the pores, and, by filling them completely, prevents the access of moisture, and consequently the injurious effects produced by it."

It is remarked, that, "in a few instances, a method different from any of these has been tried, and found in some degree to answer. Instead of sharpening the points of the standards, they are left of the same thickness at both ends; and the extremities, instead of being drove into the earth in the ordinary way, are let into large stones sunk into the earth, with round or square holes cut into them, of such a size as to admit the square ends of the posts. In that way the upright posts of palings certainly last longer than when they are drove into the earth without any preparation; but the difference of durability in the two cases bears no kind of proportion to the difference of expense; and as these stones are sunk into the earth, and of course within the reach of the moisture, the decay of the paling, though somewhat protracted thereby, is in the end equally certain. Upon the whole, when the expense and durability of these different methods are compared, it will, he says, be found by much the best way to drive the standards into the earth, after having previously prepared them by dipping the extremities into any of the articles we have mentioned; and of which, he thinks, any of the coarse oils by far the best. In addition to which he has to add, that this dipping and preparation should be so applied as to rise several inches above the surface of the earth after the standard is drove in; for, if no more is dipped than what is drove into the ground, the wood will imbibe the moisture at the surface, and very soon rot and decay at that place. Thus much of the preparation of that part of the wood which is drove or set into the earth. To render the whole paling as durable as possible, it should receive a covering, either of lord Dundonald's varnish, or one of the coarser kinds of oil-paint, or oil. Where use only is wanted, and the appearance of the paling is not an object, a coat of varnish or oil will answer very well; but when a paling is made of dressed wood; substantially executed, and in sight of the road, or of a gentleman's house, it becomes necessary to unite use with ornament. In such cases, a coat of white or green oil-paint will defend the wood equally well, and look much better; where it is intended that the paling should appear visible at any great distance, and convey any idea of inclosure, the white paint should be used; but when it is meant to conceal the fence, and give an unbroken view of extensive lawns or pleasure-grounds, the green paling is preferable; next to the ha-ha, or sunk-fence, it is the best contrivance for that purpose; being of the same colour with the grass, it is not visible to the eye at any great distance." Having thus mentioned what appears essential respecting palings in general, we may proceed to notice the different kinds that are made use of for the purpose of inclosing land.

Simple nailed Paling. This is a sort of fence that consists of upright posts, drove or set into the earth at certain distances, and crossed in three, four, or more places, with pieces of wood, in a horizontal direction. This paling is for the most part made of coarse sawn wood, without any dressing whatever: "in Scotland it is, Mr. Sommerville says, termed a slab paling, and is the one commonly employed for the protection of hedges, and for strengthening ditches, &c. For temporary purposes he thinks it answers extremely well; but that where durability is required, and no other fence is used, it will be found a very insufficient sort of fence." It is seen at *fig.* 8.

Jointed horizontal Paling. This consists of massy square poles, drove or set into the earth at regular distances, through which mortises or openings are cut, for the reception of the extremities of the horizontal pieces which traverse them. "When properly executed, this fence, it is observed, has a

neat and durable appearance. It is, however, much less so than it appears to be, as the points of the piles drove into the earth soon rot, and the mortises, or openings cut in the body of the piles for the reception of the horizontal pieces, weaken them very considerably, so much so, that, in many instances, the paling decays fast at those places where the joinings or mortises are made. It is further remarked, that, where valuable palings of this kind are made, there is an easy method of fastening the horizontal to the upright parts of the paling, without cutting or weakening any part of the upright posts. This consists in fixing the cross or horizontal bars to the upright posts with iron staples. These, while they answer every purpose that can be expected, from binding and connecting the different parts of the fence, have, it is conceived, not the smallest tendency to diminish the strength or accelerate the decay of any part of the fence." This sort of paling is represented at *fig.* 9.

Upright Lath Paling. It is made by driving or setting a number of strong piles into the earth at regular distances, and crossing these at top and bottom with horizontal pieces of equal strength; upon these last are nailed, at from six to twelve inches distance, a number of square pieces of sawn wood, of the shape and size of the laths that are used for the roofs of tiled houses. "This sort of paling, when properly executed, looks very well, and, notwithstanding its apparent slightness, if well supported by props or rests at regular intervals, lasts a long while; and where there are plantations of young firs in the neighbourhood, laths may be had at a trifling expense. For the protection of young hedges, &c. it will, the writer just mentioned thinks, be found superior to almost every other, as the closeness of the upright pieces prevent the sheep or cattle from putting their heads through between them, and cropping the young hedge; an advantage which horizontal palings do not possess. For gardens, it will likewise, he conceives, be found both useful and ornamental, and infinitely better adapted to the training of fruit trees and currants than the espalier railings commonly used." It is seen at *fig.* 10.

Horizontal Paling of young Firs, or the Weedings of other young trees. This may be had recourse to with advantage upon estates where there are extensive woods, or where they are surrounded by belts of thriving plants, the thinnings of such woods or belts being highly valuable for making palings, especially when the plantation consits chiefly of firs; the palings of young firs are of two kinds, either horizontal or upright. The horizontal resembles the jointed dressed paling described at *fig.* 9, but the upright is similar to the lath paling; it is seen at *fig.* 11. In the representation that is given, the young firs, of which *figs.* 11 and 12 are formed, have their lateral branches cut off at about three inches distance from the trunk. This method has several advantages, as that of rendering them stronger than they can possibly be, when the lateral branches are cut close by the trunk; the labour required to prune them is also less, and they make a better fence than such as are close trimmed, as the sharp projecting points prevent the sheep or cattle from leaning or rubbing upon them so much as in other cases.

But the upright paling of young firs, represented at *fig.* 12, in place of being made in the manner above described, is sometimes made by driving the upright parts into the earth, and covering them at the top with a piece of flat sawn wood, through which holes have been previously bored with a large auger, to admit the sharpened points of the upright piles: this forms a very neat paling, and, when well secured with rests at the back, lasts a considerable length of time.

Chain horizontal Fence. This is made by fixing a number of strong square piles into the earth at regular distances, in the direction in which the fence is to run; each of these piles has three strong staples or iron hooks drove into it on each side, one near the top, one within eighteen inches of the bottom, and one in the middle; to these staples or hooks, chains are fastened and stretched horizontally, in the same manner as the pieces of wood are in a common horizontal wooden fence. "When it is meant that the fence should be laid open for any temporary purpose, hooks are drove into the posts in place of staples, and the chains hung upon them; but where this is not wanted, the staples will be found the most secure method. In some cases the upright part of this fence, in place of wooden piles, such as has been described, consists of neat pillars of mason-work, with hooks or staples batted into them, for fastening the chains to; these, when properly executed, look extremely well, and last much longer than the wooden posts. In a few instances, the purpose of posts is answered very completely by large growing trees, into which hooks or staples are drove for fastening the chains, as in gentlemen's avenues, public walks, &c. For the confinement of horses or cattle, a chain-fence will answer very well; and if the pillars are of stone, will be very durable, but will be found totally unfit for inclosures, where sheep, hogs, &c. are meant to be pastured; it is besides so very expensive that it never can come into general use. In avenues, however, and public walks, and for stretching across rivers, and pieces of water where there are no floodgates, and where no other fence can be made to complete the inclosure, they will be found preferable to every other contrivance that can be had recourse to." See *fig.* 1. *pl.* XLII.

Net Fence. This is chiefly used in shrubberies and pleasure-grounds, and consists, like *fig.* 1. of a number of square piles of wood drove or set into the earth at regular distances, each of which has a couple of holes bored through it, one at top, and another at bottom, large enough to admit a rope about twice the size of a man's finger; these ropes, after being drawn through the holes, are stretched the whole length of the fence, and well secured, and upon them a strong net is fastened, of a length and breadth suited to the fence, either by sewing or tying it at regular distances with strong cord or

rope-yarn at top and bottom; it is farther secured below by one or more wooden hooks drove into the earth between each of the piles; this completes the fence; to render it durable, not only the piles, but also the net and ropes, should be covered with a coat or two of good oil-paint. "When well finished, this fence has a very pretty appearance, but is neither a durable nor useful one, as sheep and cattle readily tear and destroy it with their horns; and in many instances the sheep get themselves so much entangled, that, in struggling to disengage themselves, they are either much hurt, or entirely strangled. In point of utility, the net fence has nothing to recommend it; but has it will in many instances give a neat finished look to pleasure-grounds, it is given a place among fences." It is shown at *fig.* 2.

Rope Fence. This is nearly the same as the former, that is, it consists of upright posts, drove into the earth at regular distances, with holes bored through them for the ropes to pass: in general, they consist of three, and in some cases of four courses of ropes, like the chain-fence. "This can only be used for confining cattle or horses; for sheep they will be found quite incompetent; for stretching across rivers, or pieces of water, as has been noticed when speaking of the chain-fence, the ropes will be useful; or even for adding to the height of a stone, or turf wall, especially the latter, into which if posts are drove at certain distances, and one course of ropes put through them, such an addition will render a very insufficient fence secure and valuable. One observation seems, Mr. Sommerville thinks, necessary upon the subject of this fence, namely, that the perforating of the posts for passing the ropes through weakens them considerably; notice has already been taken of a similar mischief in the jointed horizontal paling, or posts and rails framed, and a remedy pointed out, *viz.* that of fixing the cross bars or horizontal pieces to the upright parts by staples. In the rope-fence, this may be resorted to with equal advantage, as staples or ring-bolts drove into the wood answer every purpose, without impairing in the smallest degree the strength of the posts that are used." It is seen at *fig.* 3.

Moveable Wooden Fence, Flake, or Hurdle. This is seen at *fig.* 4. It has hitherto been principally employed in cases where sheep or cattle are fed with turnips in the field, to divide a certain portion of their food at a time; in that way they are extremely useful, as the sheep or cattle, by having a given quantity of food allotted them at once, eat it clean up without any loss, which they would not do, if allowed to range at large over the whole field. There are, however, many other purposes to which stakes may be applied with equal advantage. See *Hurdle.*

Osier Willow or wattled Fence. This is made by driving a number of piles of any of the different kinds of willow or poplar, about half the thickness of a man's wrist, into the earth, in the direction of the fence, and at the distance of about eighteen inches from each other. They are then twisted, or bound together at the different places, with small twigs of the willows or poplars, as represented in the sketch. "This kind of fence has some advantages peculiar to itself; it not only forms a cheap and neat paling, but if it is done either about the end of autumn, or early in the spring, with willows or poplars that have been recently cut down, the upright parts or stakes will take root, grow, and send out a number of lateral branches; and if pains are taken the following autumn, to twist and interweave these branches properly, a permanent fence, so close as to be almost impenetrable, may be formed in two or three years. For the inclosing of marshy lands, or for completing any inclosure, where a part of the line in which the fence ought to run is so wet as to be unfit for the growth of thorns, or the building of a wall, the willow-paling will be found an excellent contrivance, and the use of it will render many inclosures complete that could not otherwise have been formed." It is shown at *fig.* 5.

Paling of growing Trees, or Rails nailed to growing Posts. This is a kind of fence made by planting beech, larch, or other trees in the direction of the fence, at about a yard distant from each other, more or less, as may be thought necessary; these trees should be protected by a common dead paling, till they are ten or twelve feet high, when they should be cut down to six feet, and warped or bound together with willows at top, and in the middle; the cutting off the tops will have the effect of making them push out a great number of lateral branches, which, if properly warped and interwoven with the upright part of the trees, in the manner described for the willow-fence, will both have a beautiful effect, and will at the same time form a fine fence, which, in place of decaying, will grow stronger with time, and may with very little trouble be kept in perfect repair for a great length of time. It is seen at *fig.* 6.

Upright, and Horizontal Shingle Fences. These are chiefly made of firs, coarsely sawn into deals, of from half an inch to an inch thick, and of different breadths according to the diameter of the tree; pretty strong square piles are drove or set into the earth, and the deals nailed horizontally upon them, in such a manner that the under edge of the uppermost deal shall project or lap over the upper edge of the one immediately below it; the fence, when finished in this manner, will have nearly the same appearance as the bottom of a boat or cutter. This description will be well understood by those who have been in North America, where not only the roofs, but the walls of many of their houses are made with shingles. "When completed, this fence is nearly as formidable as a stone wall, though, as may naturally be supposed, it is much less durable. An upright fence is sometimes made with shingles, which, when properly executed, looks extremely well, and is indeed highly ornamental; this fence is made by fixing perpendicular posts in the earth, nailing three pieces of wood horizontally, and covering these with shingles placed perpendicularly; in

this case, the shingles are not above three inches broad, and the extremities of each are pointed at the top. Several fences of this kind are to be seen upon the road from Edinburgh to Glasgow, especially upon the property of Sir W. Cunningham, of Livingstone, Walter Campbel, Esq. of Shawfield, and some others. These upright shingle fences are painted white, and have a very handsome appearance. It is seldom that inclosures of any considerable extent have been made with these shingle-fences; for folds they answer extremely well, and can be shifted with as much ease as flakes from one field to another; they are also useful for temporary purposes in gardens, &c.; and where turnips are eaten with sheep upon the field, these shingle-fences will be found preferable to the common open flakes, from the shelter they afford to the sheep." They are represented at *figs.* 7 and 8.

Warped Paling Fence. This consists of pieces of wood drove into the earth, bent down in different directions, and their tops fastened together; this fence resembles the chevaux-de-frise, with this only difference, that, in place of leaving the points standing up, as is the case with that part of fortification, they are bent down and tied together. When made of dead wood, this fence is equally perishable with others of the same description; but when made of growing plants, it will be found very lasting. It is seen at *fig.* 9.

Light open Paling Fence with Thorns, or the Branches of Trees wove in. This differs from the common nailed fence already described, only in being warped either with thorns, or the branches of trees. When properly done, it forms at once a very complete fence; but, like all fences made with dead wood, it will be found very perishable, and require many repairs. It has, however, one advantage, *viz.* that, when properly executed, it is proof against the entrance of animals of any kind. It is seen at *fig.* 10.

Wall-Fences are constructed of different sorts of materials, and are of various kinds. In England they are commonly known by the name of walls, but in Scotland more frequently by the title of dikes. " They are for the most part good fences, though some of them, as those of the earthy kinds, are not by any means durable, therefore should not be formed where other better sorts can be had recourse to. In the construction of walls, it is essential that the stones be either taken from a quarry, or consist of the largest land-stones broken in such a manner as that they may have a good flat surface, in order that they may bind well; that they be built by masons and well pinned; that they have as dry and deep a foundation as possible, in order to guard against frosts, &c.; that they be made wide at the bottom, and tapering upwards to about the breadth of ten inches, when the coping is to be applied; that the coping consist of materials that cannot be readily overturned or removed; as, upon the manner in which it is finished, much of the future value and durability of the wall will be found to depend.

It is observed, that "dry stone walls are sometimes erected by common labourers with the round stones gathered from the fields, and coped with sod; in other cases, they are made with quarried stones, upon which some pains have been bestowed to put them into proper shape; a third kind, known by the name of Galloway dike, and so denominated from the circumstance of its being originally used in that country. The first of these, viz. the wall or dike made with round or land-stones, by labourers, and covered with a coping of sod, is, it is said, a very indifferent fence. In most instances, it is not only very ill constructed as to shape, being of one uniform thickness from top to bottom, but the stones, from their round figure, do not present a sufficient surface to each other, to bind and give stability to the building. This fence has long been known, and is still very common in the remote parts of the country, upon estates where the first rude essay is made in the way of improvement, and where masons cannot readily be had. In such situations, it has a two-fold benefit; the surface is cleared of many stones that would otherwise have presented a considerable obstacle to its cultivation, and the field is at the same time inclosed: but, though these objects are accomplished for a time, their benefit is not permanent, as the wall is perpetually tumbling down; even the cattle rubbing against it make considerable gaps in many places; in that way, great trouble and expense are annually required to keep it in repair. At *fig.* 11. is represented a dry stone-wall coped with brick, and at *fig.* 12. a dry stone-wall coped with turf.

It is asserted, that " when the stones with which dry walls are built are quarried, and done by skilful masons, broad at bottom, tapering gradually upwards, and finished at top with a substantial coping, the fence has a very neat appearance, and has been known to last thirty and even forty years without repairs. A good foundation is highly essential in the construction of this fence; from nine to twelve inches is the smallest depth that it should be below the common surface, especially if the soil is open and porous, and the largest and heaviest stones should always be laid undermost. In cases where the materials do not require to be brought from any great distance, a hundred yards in length, by six feet in height of such a wall, may be built for 18*l.* or 20*l.* It is customary in some parts of England to plant ivy both upon their dry stone-walls, and upon such as are constructed with stone and clay: this has a good effect, not only in point of appearance, but after a while it binds and strengthens them very considerably. There are several kinds of ivy, viz. the large and the small leaved, the dark green and variegated, all of which look well; those kinds, however, should have a preference that grow fastest, and have the greatest tendency to ascend. Particular care should be taken, we are however told, not to plant ivy in the immediate neighbourhood of young trees or hedges, as, next to moss, nothing can be more destructive to trees or hedge-plants than this.

It is noticed, that "where dry stone walls are built, that which we have just described deserves a preference, on account of its neatness and durability. It is not only much cheaper than one made with stone and lime, but is equally useful, looks as well, and admits of being practised in many situations, where lime is either exceedingly scarce, or not attainable but at an enormous price. In many cases, it is common, after raising this wall to the wished-for height, to level the top of it with loose stones, and leave it in that situation, without any coping or other security. The consequence is, what might naturally be expected, the first person who attempts to climb over it, or the first horse or bullock that puts its head over the top, or attempts to rub itself against it, infallibly throws down a part of the stones, and in that way the fence is gradually destroyed: whereas, when a substantial coping of stone and lime is given, the wall is so completely bound together and consolidated at top, as to bid defiance to any common injury. The copings of turf and mud, so common in many places, are by no means entitled to approbation; for, though they may for a short time secure the top of the building, they soon decay, and cannot be procured, but by paring and cutting off the adjoining surface: for these reasons, turf or mud copings are improper, even upon dry stone walls: upon those made with stone and lime, or stone and clay, as we shall afterwards have occasion to notice, they are wholly to be reject.d."

Stone and Lime Walls. With regard to stone and lime walls, "in order to render them durable, they should be constructed in the manner above described, for dry stone walls; that is, have a good foundation, deep enough to prevent them from being hurt by frost, with a broad base, tapering gradually upwards. This fence, when properly executed, is (next to hedges) the most durable of any; it is, however, very expensive; and its superiority over the dry stone wall is so trifling in point of durability, as to render the latter the most eligible, it being greatly cheaper, and answering every purpose of a fence equally well. For the building of this wall, stones taken from the quarry are to be preferred to the common land-stones; for though a mason may be able to remedy, in some measure, the inequality of surface in land-stones, by mixing plenty of lime with them, yet experience proves, that walls made with such stones, notwithstanding every care on the part of the builder, are much less perfect, and last much shorter time, than where quarried stones are employed. This, like every other stone fence, should be secured at the top with a substantial coping of stone and lime; the best and most durable is, it is said, that which is made with stones of the flag kind, laid together in the form here represented Λ; the space between them being filled with a mixture of small stones and mortar. This coping, from its wedge-like shape, and the solid impenetrable surface which it presents to the weather, seems the best calculated of any for the preservation of the building. When a stone and lime wall is left without a coping, which is too often the case, the moisture finds its way readily into the heart of it; it is, besides, liable to all those accidents already mentioned, in speaking of dry stone walls, when they are left without a coping. When stone and lime walls are built, the season of the year at which the work is done is none of the least important considerations; for if they are erected either at a late period of the autumn, during the winter, or very early in the spring, the frost acting upon the moisture contained in the lime, will separate and disunite its parts, and by that means destroy the cohesion of the building; the binding power of the lime, in such cases, is entirely lost, and when summer arrives it resembles dry sand mixed with the stones." Late in the spring, during the summer, or early in utumn, seems to be the most proper time for building stone and lime walls; at any, or all, of these periods, there is every prospect of the lime drying properly, and not the smallest risk of its binding quality being hurt by the effects of frost.

Galloway Dike or Wall. The Galloway dike, as has been already noticed, owes its name to the circumstance of its being first used as a fence in that part of the country. "It is now, however, very common in most parts of Scotland, and in some of the English counties. It is principally employed for inclosing high grounds that are depastured with sheep, for the confining of which it seems well calculated. From two feet to two and a half, at the bottom, it is built in a regular compact manner with dry stones, in every respect the same as a dry stone wall, with a broad base, tapering gradually upwards: the building is then levelled with a course of flat stones, resembling a coping, in such a manner as that these flags or flat stones shall project two or three inches over the wall on each side. Above these flat stones is laid a course of rugged round ones, placed upon each other in a way secure enough to give stability to the building, but at the same time so open as to leave a considerable vacuity between each; by which means a free passage is afforded to the light and wind, which blows through them with a violent whistling noise. This rough open part of the building is generally raised three feet above the regular part of it, gradually tapering upwards, till it terminates in a top of about nine inches broad, every course of the rough stones being smaller than that immediately beneath it. Its tottering appearance is so well calculated to prevent sheep, cattle, or other animals, from approaching it, that it is seldom indeed that any attempt is made to leap over it. This circumstance, together with the ease with which the stones are procured, in most of the situations where the Galloway dike is used, renders it a valuable fence. The expense of erecting it will be very different in different situations, according to the ease or difficulty of procuring stones, the price of labour in the country, and other circumstances. In many cases where the fields to be inclosed are infested with large stones, the removal of which ought always to be a previous step in every plan of improvement, the inclosure may be made for a trifle, merely for the expense of mason-work. In no in-

stance can it be dear; and in most situations, where the confinement of the stock, or the partition of a crop, are the sole objects, this will be found to answer the purpose equally well, if not better, than more expensive fences. It has, however, one defect: it is observed, in common with all other stone fences, *viz.* that it neither shelters nor ornaments the country; indeed, in point of shelter it is the most defective of any; for compact stone walls, of a proper height, are capable of affording considerable shelter to the grazing stock in stormy inclement weather—an advantage which cannot possibly be expected from the Galloway dike, on account of its openness." On that account it appears much more eligible for the lower parts of the country, where the land is valuable, where little shelter is required, and where the confinement of the stock, or the protection of a crop, are the sole objects.

The advantages of stone fences of every description are, it is remarked, very considerable; "they not only form complete inclosures at once, and by that means allow the proprietor to enter into immediate possession of every advantage that can arise from the inclosing of his fields, but, by the little room they occupy, a considerable portion of land is saved that would have been occupied by some other fences; and even that proportion of soil near the sides of stone walls, which is at present for the most part waste, admits of being profitably employed, either in raising grain, potatoes, or other vegetables; and the walls, as we have already observed, may be usefully employed in rearing of fruit-trees, or the different kinds of currants, gooseberries, &c. &c. To these benefits we have, however, to oppose some defects. The best and most substantial fences of this description are perishable in a greater or less degree, according to the materials of which they are made, and the judgment shown in their construction, and, after a certain time, require considerable attention and expense to keep them in repair; the shelter they afford to the stock, crop, or pasture, is also small, and in place of improving the scenery they are injurious to it. A fence of this sort is seen at *fig.* 1. *pl.* XLIII.

Stone and Clay Walls. In the construction of walls of stone and clay, the clay is used like lime, and is meant to answer the same purpose. "It requires slender observation, the writer says, to convince intelligent persons, that a wall made with such materials in the ordinary way cannot be a durable one; for if the clay made use of in building the fence has been very moist, the summer's heat will dry it so much, as to leave considerable chasms in the building; these chasms must necessarily deprive many of the stones of that support which they require, and in that way endanger the building. This, however, is not the only inconvenience with which this kind of wall is attended; the effect of the summer's sun upon the clay parches it so completely, that when the wet weather commences about the end of autumn, it absorbs the moisture like a sponge, and if it is overtaken by frost while in that state, the fabric swells, bursts, and tumbles down. Even with the very best coping that can be given it, a stone and clay wall must, it is remarked, always be considered as a very exceptionable fence, as, however well it may be defended at top, the moisture will penetrate at the sides: if it is left without a cope, however, or is only coped with mud or sod, the evil will be greater, as the moisture will in that case find a ready passage downwards, and in that way accelerate the destruction of the wall" or fence.

And walls of stone and clay, dashed with lime, differ in no respect from that just now described, except in the harling or dashing that is given them. "Where that operation is well performed, and at a proper season of the year, the coating of lime, by preventing the entrance of moisture, will add greatly to the durability as well as beauty of the wall; so much so indeed, that some fences made in this way, where the clay was properly tempered, and did not contain too much moisture, and where a harling or dashing of lime was afterwards given, have been known to last nearly as long as walls made entirely with stone and lime." The durability of this, as well as the foregoing fence, however, depends upon its being properly coped or covered at the top.

Dry Stone Wall, lipped with Lime. This differs from the ordinary dry stone wall, in having about two or three inches of it on each side lipped with lime, which gives it the appearance of being built entirely with stone and lime. Where the external appearance of a fence is an object, something is gained by this practice; in point of real duration, however, it seems to possess very little advantage over the common dry stone wall, which, when properly executed, lasts equally long.

Dry Stone Walls, lipped and harled. These are much the same, nothing more being added than a harling or dashing of lime after the other work is finished: this addition is to be considered merely as an improvement upon their appearance, and not as contributing to increase their utility, or render them more durable as fences.

Dry Stone Walls, pinned and harled. These are much the same: the mason only carefully pins or fills up all the interstices of the building with small stones, after they have been built in the ordinary way, and afterwards dashes or harls them over with lime. The pinning, by filling up every vacant space, and affording complete support to the stones in every part of the surface, adds considerably to the durability of the building, and the harling afterwards gives the whole a finished substantial appearance, which renders them at once agreeable to the eye, and lasting as fences.

Dry Stone Walls, with a light Paling upon the top. These are sometimes made, and for particular purposes answers well, and have a handsome appearance when well executed. A fence of this sort is seen at *fig.* 2.

Brick Walls. These are seldom had recourse to for ordinary inclosures, except in situations where stones are extremely scarce, as is the case in many of the English counties for pleasure-grounds, or for garden-walls. "Where brick walls consist of bricks

only, they are built either with the brick on edge, in bed, or across. When the wall is built with bricks on edge, they are laid up with the edge or narrowest part of each applied to the other: the thickness of the brick in such a case constitutes the thickness of the wall. When brick in bed, is used, the bricks are laid flat, and the thickness of the wall is proportioned to the greatest breadth of the brick. When they are laid across, the thickness of the wall is then equal to the length of the brick that is employed."

It is observed, that "the most valuable use to which bricks are applied is either for facing walls built with coarse stones, for gardens, or for heightening old stone walls: for the first purpose, they are an excellent article; and any wall fronted with brick is, for the purpose of rearing fruit-trees, of equal value with one of the most expensive hewn-stone. Where it is intended to heighten a stone wall that is too slender to bear a heightning of stone, bricks, either in bed or on edge, will answer the purpose very effectually, without rendering the wall top-heavy. It is to be noticed, however, that in every case, either where a wall is made entirely of brick, or heightened with it, there will be a necessity for strengthening it at the back with pillars at certain distances from each other, as represented in *pl.* XLIII. *figs.* 3 and 4; these will add to the stability of the building, and, if properly executed, will render it equally durable with a stone wall. For hot walls they are very valuable, as they not only, by their numerous seams, allow the trees to be regularly and neatly trained, but are at the same time extremely convenient for shaping the flues that conduct the heat. Where the price of labour is low, and clay of a proper quality, together with fuel, can be easily obtained, bricks may be used with advantage for almost any purpose where stone is at present employed: we believe, however, that their use will be chiefly confined to the facing of garden-walls, to the walls of hot-houses, to hot walls, or the heightening of old stone walls; in all of which they will be very valuable, and will, at a small expense, answer the same purpose as stone that has been prepared by hewing." A brick wall is seen at *fig.* 5.

Walls of this kind are variously coped; "in some cases it is done with the common brick, set up in such a way as to form an angle upon the top; in others, with a sort of tiles resembling the letter A, flat below and angular above, with a border projecting a little over the wall on each side. In different parts of England, this coping is found to answer the purpose very effectually; in some instances, however, it is made entirely flat, which is disapproved of, on account of its not affording so ready a descent to the moisture."

Frame Walls. These are constructed in the following manner: "a frame of deal boards, of a width and height proportioned to that of the intended fence, is placed upon the line in which it is intended to be made, a proper foundation having been previously dug: the frame is then filled with stones of all sorts, gathered principally from the adjoining fields: when the frame is filled to the top with such stones, a quantity of liquid mortar is poured in amongst them, sufficient to fill up every interstice; the whole is suffered to remain in that state till it is supposed that the mortar has acquired a suitable degree of firmness to give stability to the building, which in summer, when the weather is warm and dry, will not require above a day or two. The frame is then removed, and placed a little farther on in the same line, in such a manner as that one end of it shall join immediately with that part of the work from which it had been removed. In that way the line of fence is gradually completed, which, when the lime has been well tempered, and the proper pains taken to incorporate it with the stones, presents a smooth uniform surface, and appears to be firm and substantial."

Turf Walls. These are met with in almost every upland or hilly district throughout Britain, and for temporary purposes are found very useful. "In a variety of instances this sort of fence is used for inclosing fields, and is practised for that purpose to a very considerable extent; in others, however, it is used for the formation of folds, pens, or other places of confinement for cattle during the night. In general, the fence is made with turf only, pared off from the adjoining surface, and used without any mixture of earth; in other cases, the wall consists of a facing of turf on each side, while the space between is filled up with loose earth. For a fold, or any other temporary purpose, this fence, it is observed, answers extremely well; but for inclosing a field, or indeed any other use where durability is required, it should never be had recourse to, as, from the moment it is finished, its decay commences, and no pains or attention will be able to keep it in repair after it has stood two or three years. In very exposed situations, however, it may be useful as a protection for young hedges, during the first three or four years of their growth; but as a wall of this kind can in no instance be made without a destruction of the adjoining surface, which upon good lands is a serious loss, the protection of young hedges will be answered equally well by low stone-dikes, which, while they perfect the inclosure, will at the same time shelter the young plants, and clear the field of stones." It is shown at *fig.* 6. See *Dyke.*

Stone and Turf Walls. These are also very common in many situations, where better and more durable ones could be made at equal, perhaps less, expense. "In many instances, however, it is had recourse to, from necessity, where lime is either very dear, or not attainable at any price. The stones used in the construction of fences of this kind are in general the ordinary land stones; with these, and the turf taken from the adjoining surface, the walls are made, using alternate layers of each. For temporary purposes, this sort of fence may be adopted in almost every situation, as it is reared at small expense, and the materials are every where to be met with, almost without trouble: but in all cases where permanent fences are wanted, this will be found very

deficient, even to the common turf wall; for, by the intervention of stones between every layer of turf, the sod is dried, the plants die, the turf, as might naturally be expected, soon decays, and the wall crumbles down; whereas, when it is built entirely of turf, with a sloping bank of earth behind, the herbage continues growing, and the whole turf of which the wall is made soon consolidates into an uniform green sod, which, with proper care, will last for a considerable length of time." A wall of this sort is seen at *fig.* 7.

Mud Walls with a Mixture of Straw. These are very frequent in many parts of England, not only for surrounding their small inclosures and stack-yards, but also for constructing the walls of many of their farm-houses and offices. "In North-Britain, they are used for similar purposes, and for subdividing houses into different apartments; for which purpose they answer equally well as lath and plaster, and are nearly as durable."

It is remarked that, "when either the outside walls or the inside divisions of a house are made of these materials, the custom is, to take a small quantity of straw, and incorporate it with a sufficient proportion of clay; the straw in this case answers the same purpose as hair in plaster-lime. When a sufficient number of these are made, the work is begun by laying a stratum at the bottom of the intended wall; when this is done, and the different pieces firmly kneaded, or wrought together with the hand, a flat deal board is applied on each side, which being properly pressed, and rubbed against the building in a horizontal direction, not only serves to consolidate the work, but gives it a degree of smoothness and uniformity; successive stratums are added, till the wall is raised to the intended height, taking care to taper it gradually upwards. Walls made in this way, if properly constructed, will last for many years, and if dashed or harled with lime, at a proper season of the year, will have an appearance no way inferior to such as are made with stone and lime, along with this addition to their appearance, the harling or dashing with lime, if properly done, will, by preventing the access of moisture, render them much more durable. When walls of mud and straw are to be made, pieces of wood properly joined and secured should be set up in the direction in which the fence is to run. These should be in the form of a double paling, and calculated to answer the same purpose as the standards employed in making brick divisions in a dwelling-house; the upright parts should be placed in such a manner as to be immediately opposite to each other, and at a distance equal to the thickness of the intended wall. These standards will not only render the fence firmer and more durable, but at the same time serve as a direction to the workmen, in keeping it of a regular thickness and shape. In England, where stones are scarce, and in many of the counties not to be had, walls of this description are the *sine qua non* for many purposes, and, when properly constructed, last a considerable time; but in every instance where stones are procurable at a reasonable price, a fence made with them is greatly to be preferred; as it is in general built with less trouble and expense, and is at the same time much more durable. At best it is, however, of a very perishable nature, and the great expense required to keep up such fences has long since taught both proprietors and occupiers that they are by much the most expensive of any. A wall of this kind is seen at *fig.* 8.

A plummet employed in the building of stone walls is seen at *fig.* 9. And at *fig.* 10. a section of a dry stone-wall.

FENNEL, the name of a well-known plant cultivated in kitchen-gardens, and sometimes in the field for the seed. It is propagated by the seeds, which ripen in autumn, and should be sown soon after. They will come up in the spring, and require no other care than to keep them clean from weeds. This plant will grow in any soil or situation.

FENNY, partaking of the nature of moor, marsh, or bog.

FENNY-*Land*, such land as is of the nature of fen. The extent of this sort of land in different districts is very considerable, and capable of much improvement by means of proper drainage and cultivation.

It has indeed been observed by lord Dundonald, that the proper management of this sort of land by such methods "would, by rearing and feeding a greater number of cattle of all descriptions, allow a greater proportion of the higher and drier lands to be kept in tillage; whence would be produced a greater quantity of grain and animal food. The present inhabitants of Great Britain would be more reasonably and plentifully fed and cloathed, and a considerable surplus would be left either for exportation, or for the maintenance of an augmented number of people." And that "population would increase as plenty is secured. The additional produce of the earth would not only feed a greater number of inhabitants, but would provide them with constant employment in the manufacturing of wool, hides, hemp, and flax, the internal productions of our own island, instead of relying upon a precarious supply of some of these necessary articles from foreign states; and lastly, *emigration*, the constant attendant on scarcity, would no longer *rob* these kingdoms of their only defence."

It is obviously, therefore, a matter of vast importance to have the lands of this sort in the different parts of the kingdom, which at present lie in a state of waste and neglect, brought into a proper state of cultivation and improvement. And experience has fully shown, that much may be effected in such sorts of land after they have been rendered in some measure dry, by the growth of cole or rape for the purpose of being fed off by sheep. See *Fen* and *Marsh*.

FERMENT, any substance employed to raise or produce fermentation, when mixed with or applied to another, as yeast, wine-lees, leaven, &c. Ferments are therefore either such substances as are already in the state of fermentation, or have the dis-

position of readily taking on or running into it. Examples of the first kind are met with in fermenting liquors of different kinds, as wine and beer, and the flowers or heads thrown up by them, and of the latter sorts in the newly expressed saccharine juices of various summer fruits.

FERMENTATION, a sensible internal motion excited among the particles of most fluids or compound substances, by the continuance of which they undergo different changes, and form new combinations, that in many instances have not the least resemblance to the original matters in their properties. The term ought, perhaps, properly to be confined to the vegetable and animal classes of matter; for the effervescences between acids and alkalis, however much they may resemble the fermentation of vinous liquors, are nevertheless exceedingly different. It is divided into three kinds, or rather there are three different stages of it, viz. the vinous, the acetous, and the putrefactive. Of the first, vegetables alone are susceptible: the flesh of young animals is in some slight degree susceptible of the second; but animal substances are particularly susceptible of the third, but which vegetables do not so easily fall into without previously undergoing the first and second. The produce of the first stage is wine, or some other vinous liquor; of the second, vinegar; and of the third, volatile alkali.

It is observed in Mr. Nicholson's Dictionary of Chemistry, that it is considered as an established fact, that the three stages of fermentation always follow each other in the same order in such bodies as are susceptible of them all; the vinous coming first, which is followed by the acetous and putrefactive processes; and that these spontaneous effects are greatly retarded by extreme cold, or by sudden desiccation, or by preservation of the bodies in vessels so well closed as to prevent the escape or absorption of elastic fluid. The two first of these necessarily retard the chemical processes, by depriving the parts of the requisite fluidity; and it may without difficulty be understood, that the changes of combination cannot by any means be completely made, while the communication with the open air, the great receptacle and solvent of volatile matter, and one of the chief agents in the great operations of nature, is cut off.

The three conditions for the due accomplishment of fermentation will therefore, he remarks, be fluidity or moisture; moderate heat, or a due temperature; and the access of air. It will of course be modified also by the component parts of the body itself.

And further, that, as the vinous fermentation has never been found to take place where sugar was not present, it appears the most simple to consider what happens when mere sugar and water in due proportions are exposed to fermentation. If, says he, a considerable quantity of water, holding in solution about one-third of its weight of sugar, be exposed to the air, at the temperature of about 70 degrees of Fahrenheit's thermometer, after the addition of a small quantity of yeast, it soon undergoes a remarkable change. In the course of a few hours the fluid becomes turbid and frothy; bubbles of fixed air are disengaged, which rise and break at the surface. This disengagement becomes more and more abundant; mucilage is separated; part of which subsides to the bottom, and part, expanded into froth by the elastic fluid, forms yeast. During the course of several days these effects gradually come to their height, and diminish again; after which they proceed very slowly, but are long before they entirely cease. The fermented liquor has no longer the sweet taste it had before; but becomes brisk and lively, with a pungent spirituous flavour. Its specific gravity is likewise considerably less than before: and when exposed to distillation, it affords a light inflammable spirit miscible with water in all proportions. The quantity of ardent spirit which any fermented liquor will produce, is thought to follow some proportion of the change its specific gravity undergoes in fermentation; but the truth of this has not been clearly ascertained. Wine, cyder, and beer, are well-known liquors of this kind.

This is one of the most obscure processes in nature, and no attempt has been made to solve it with any degree of probability. All that we know with regard to it is, that the liquor, however clear and transparent at first, no sooner begins to ferment, than it becomes turbid, deposits a sediment, emits a great quantity of fixed air, and throws up a scum to the top, acquiring at the same time some degree of heat.

These phænomena seem to point out fermentation as a process ultimately tending to the entire dissolution of the fermenting substance, and depending upon the action of the internal heat, etherial fluid, or whatever else we may please to call it, which pervades and makes an essential ingredient in the composition of all bodies. From such experiments as have been made upon this subject, it appears, that whether fixed air be the bond of connection between the particles of terrestrial bodies or not, the emission of it from any substance is always attended with a dissolution of that substance. We cannot, however, in the present case, say that the emission of the fixed air is the cause of the fermentation. It is in fact otherwise. Fixed air has no tendency to fly off from terrestrial substances with which it is united; on the contrary, it will very readily leave the atmosphere after it has been united with it, to join itself to such terrestrial substances as are capable of absorbing it. The emission of it, therefore, must depend upon the action of some other fluid; most probably the fire or heat, which is dispersed through all substances in a latent state, and in the present case begins sensibly to manifest itself. But from what cause the heat originally begins to operate in this manner, seems to be entirely unknown and inexplicable, except that it appears somehow or other to depend on the air; for, if that is totally excluded, fermentation will not proceed.

The experiments of Mr. Henry, as detailed in the Memoirs of the Literary and Philosophical Society of Manchester, would seem however to show that the carbonic acid or fixed air is the cause of the process

while those of Dr. Pennington, of Philadelphia, seem to prove that it consists in the action of elementary fire expanding the fixed air naturally contained in the fluid, or artificially introduced into it; in consequence of which certain changes are produced in the nature of the fluid itself; and it becomes a vinous, acetous, or putrid liquor, according to the degree of action that takes place.

The fermentable class of vegetables are extremely various, and might be distributed into as many classes as they require different methods of fermentation. It will, however, only be necessary here to mention such as are connected with the business of agriculture.

The first class of fermentable substances includes all the pulpous summer fruits, which, when ripe, abound with a tartish sweet juice: such as grapes, apples, pears, elder-berries, gooseberries, rasberries, currants, cherries, plums, and all other summer-fruits, provided they be kept free from a tendency to putrefaction.

The second class contains the fresh expressed and native juices of plants, provided they be of a tartish and sweetish taste; such as the juice of the sugar-cane, of liquorice, and other similar plants. To this class may be added all the juices which distil from certain trees when wounded, especially in the spring; as the birch, the plane or maple, the vine, the walnut-tree, &c. The maple has, it is said, this remarkable property, both in the small kind and in the large, which is called the sycamore, that, being tapped, it will bleed freely in the winter, and its juice flow very plentifully even after a hard frost.

The third class comprises those vegetable juices which are formed and inspissated by nature into a certain saponaceous substance, consisting of saline and oily particles; such as honey, manna, and all other juices which are not gummy or unctuous.

The fourth class comprehends all those seeds which, when ripe and dry, may be ground into a fine meal, without their forming an unctuous paste; such as barley, wheat, oats, rye, &c.

Certain circumstances are requisite to render these different substances fit for fermentation; namely, first, a perfect degree of sweetness or maturity suitable to each kind. All seeds and fruits which are so perfect, as, when sown in fertile ground at a proper season, and in a proper climate, to produce a plant of their own species, are fit for this operation. Another circumstance, which has sometimes been considered requisite to fermentation, is a moderate proportion of oil: for though fat matters are more apt to grow rancid than to ferment, yet, if they are entirely deprived of their oils, they are thereby also rendered unfit for fermentation. Thus bruised almonds, which are rich in oil, will scarcely ferment; but they may be so far freed from their oil by art, as to be made fitter for this purpose. Solubility in water is a third and principal requisite in fermentable substances.

The methods of preparing different fermentable substances for fermentation will be given in their proper places. See *Cyder*.

The sweet juices of summer fruits are, of their own nature, greatly disposed to ferment, so as immediately to begin this operation, without the addition of any ferment. Many other liquors, however, stand in need of the help of ferments, to begin the process, which, under proper conduct, proceeds afterwards of itself. The chief ferments are the recent flowers, commonly called yeast, thrown up to the top of beer in the act of fermentation. If this rarefied frothy matter be mixed with other fermentable liquors, it greatly promotes their fermentation. The same matter become heavier, and sunk to the bottom, provided it be not too stale, still retains the same power, though in a less degree than in its former state. The remains of former fermenting liquors sticking to the sides of casks have the same effect; for casks thoroughly penetrated by the subtilty of wines, which they formerly contained, are extremely apt to raise a violent and quick fermentation in the fresh liquors put into them. Acid paste of flour fermented, or baker's leaven, may all be employed for the same purpose: for though meal may be preserved fresh and sweet during years, if it be kept in a dry state, and perfectly free from insects; yet if it be wrought with water into a soft close paste, and lightly covered in a warm place, it will soon begin to heave, be all over full of cavities, change its smell, colour, and tenacity, prove acid both to taste and smell, and thus become that proper ferment from which the whole of this operation first took its name. When thus prepared, if part of it be mixed with other paste, fresh and not yet fermented, it will cause it to ferment much sooner, and more strongly, than it would otherwise do. Hence we need not be solicitous about a first ferment, because nature affords it spontaneously every where. In order to promote this process, in addition to the circumstances stated above, it will sometimes be necessary to introduce actually fermenting matter.

The time requisite for the perfect completing of fermentation can hardly be determined, because it is different in different liquors, and depends much on the season of the year, the temperature and situation of the place, and heat of the weather. It proceeds slower in the northern countries than in hot climates. In the heat of summer it proceeds quick, but in winter more languidly; and the sweeter and richer the juice is, and the longer does the fermentation continue, the stronger and more spirituous is the wine or other liquor produced from it.

When it is required to preserve fermented liquors in the state produced by the first stage of fermentation, it is usual to put them into casks before the vinous process is completely ended; and in these closed vessels a change very slowly continues to be made for many months, and perhaps for some years. But if the fermentative process be suffered to proceed in open vessels, more especially if the temperature be raised to 90 degrees, the acetous fermentation comes on. In this the vital air of the atmosphere is absorbed; and the more speedily in proportion as the surfaces of the liquor are often changed by lading it from one vessel to another. The usual method consists in exposing the fermented liquor to the air in open casks, whose aperture at the bung is covered

with a tile to prevent the entrance of the rain. By the absorption of vital air which takes place, the inflammable spirit becomes converted into an acid. If the liquid be then exposed to distillation, pure vinegar comes over instead of ardent or pure spirit.

FERN, the name of a most troublesome weed, which is very difficult to destroy where it has a deep soil to root in. The best method of killing it is probably by cutting it often while it is in its green and most succulent state, as in the spring or the beginning of summer. The fern thus cut when full of sap, and left to rot upon the ground, tends greatly to improve the soil, by rendering it more mellow, or, if it be burnt when so cut, it will yield a much greater quantity of saline matter than any other sort of vegetable.

This is, however, a wasteful practice, and by no means so good as that of collecting it and stacking it up for the purpose of littering the fold-yards during the time the cattle are kept in them, as, by such a method, a large stock of valuable manure may be accumulated, the fern retaining the moisture and liquid animalised matters better than straw, by which it becomes in a fit state for manure much sooner than is generally supposed. It may likewise be used as thatch, though it is inferior to many other materials, but will last ten or twelve years.

Fern-*Web*, a term applied to a sort of small chaffer, injurious to the early blossom of the apple-tree.

FERTILE, fruitful or abundant.

Fertile-*Soil*, that sort of soil, which, from the nature of its constituent principles, is capable of producing full crops. See *Soil*.

FERTILITY, fecundity, fruitfulness.

FESTING-PENNY, a term provincially applied to the earnest given to servants when hired at fairs or other places.

FESTUCA, a genus of grasses, of which there are several species, and some that may be cultivated with advantage. It is the fescue-grass. See *Grass*.

Festuca *Cambrica*, the Welsh fescue-grass, which is somewhat like the *festuca duriuscula* in appearance and qualities. Mr. Curtis observes, that he never could obtain any perfect seed from it at his botanic garden.

Festuca *Duriuscula*, the hard fescue-grass. This grass, Mr. Curtis says, affects such situations as the smooth-stalked meadow-grass, and sheep's fescue, all three being not unfrequently found on walls; it is common also on our downs, and in our meadows and pastures; according to situation, it varies much in size and breadth of leaf, as well as colour of its panicle, but in all situations is very distinct from the *ovina*, or sheep's fescue.

He asserts that it is early and productive, and that its foliage is fine, and of a beautiful green; hence he has thought it of all grasses the fittest for a grass-plat, or bowling-green; but he has found, that though it thrives very much when first sown or planted, it is apt to become thin, and almost disappear after a while: from its natural place of growth, it appears, he says, to be a proper grass to unite with those intended for sheep pasture-lands.

Mr. Sole, in the ninth volume of the Letters and Papers of the Bath Agricultural Society, remarks, that it is an excellent grass, and worthy of cultivation; and that it affords rich pasture, and makes the finest hay. It grows from three to four feet in height. It is common in all the meadows about Bath in Somersetshire.

Festuca *Elatior*, the tall fescue-grass, which is very similar, Mr. Curtis says, to the *festuca pratensis*, yet specifically different; it is found naturally in marshes, in which it grows to a great height, is hardy, and very productive, but, he apprehends, too harsh and coarse for hay, yet may, perhaps, be a good grass for soils which cannot be drained of their too great moisture, are overrun with meadow-sweet and such-like weeds, or which are apt to be overflown with water.

It is farther observed, that as the seeds of this plant, when cultivated, are not fertile, it can only be introduced by parting its roots and planting them out; in this there would, says he, be no great difficulty, provided it were likely to answer the expense, which he is strongly of opinion it would in certain cases; indeed he has often thought that meadows would be best formed by planting out the roots of grasses, and other plants, in a regular manner; and that, however singular such a practice may appear at present, it will probably be adopted at some future period: this great advantage would, he says, attend it, noxious weeds might be more easily kept down, until the grasses and other plants had established themselves in the soil.

It is observed in the Letters and Papers of the Society mentioned above by Mr. Sole, that it is a very luxuriant and productive grass, but coarsish; cows, he says, are fond of it, but not horses. It grows in the moist shady borders of the best pastures in that neighbourhood; and that it is from five to six feet high.—There is a moist shady bank, about a quarter of a mile out of Sherborne, in the way to Dorchester, where he has seen it at the prodigious height of eight feet.

Festuca *Fluitans*, the flote fescue-grass, which is a most excellent grass, according to the account of Mr. Sole, as stated in the ninth volume of the work just mentioned, and which cattle are so fond of, as often to endanger their lives at getting at it; but still, as it always chooses water with a miry bottom to grow in, it cannot be cultivated. It is, he says, to this grass that we are indebted for our fine Cottenham cheese: the land all round Cottenham, in Cambridgeshire, abounding with this grass. Mere and Cheddar cheeses also owe their fame, in a great measure, to this grass. It is the Maddington long grass of Mr. Stillingfleet. It grows plentifully in the moors under Cheddar, Glaston, Mere, &c. and in ditches and ponds about Bathwick and Lyncombe, &c. See *Alopecurus Geniculatus*.

Festuca *Loliacea*, the darnel fescue-grass. This grass, according to Mr. Curtis, is found sparingly

in good meadows near London, is extremely similar to the *lolium perenne* in appearance, but taller, and more productive; its foliage is harsh, and, like the *lolium perenne*, it runs too much to stalk; it is undoubtedly, he thinks, a distinct species, very hardy, tolerably early, of very rapid increase, yet not by creeping roots; more deserving of trial than many which have been pompously recommended. From the seeds of this grass being in the same predicament as those of *festuca elatior*, the plant can only, he says, be propagated in the same way.

FESTUCA *Ovina*, the sheep's fescue-grass. Mr. Curtis, in his Tract on Grasses, says, that from observations made on this grass where it grows wild, and from cultivating it in a moist soil, the reverse of its natural one, he is induced to think differently of it from most writers. Linnæus, he says, if he is not mistaken, was the first who considered it in a favourable point of view: in his *Flora Suecica*, he says, he thus speaks of it: "This grass is a principal food of sheep, who have no relish for such hills and heaths as are without it;" hence he calls it *ovina*. And that Gmelin, in his *Fl. Siber.* says, "that the Tartars choose to fix during the summer in those places where there is the greatest plenty of this grass, because it affords a most wholesome nourishment to all kinds of cattle, but chiefly sheep." It is possible, he thinks, that in the more elevated parts of northern Europe this grass may differ somewhat in its appearance and produce from what it does with us: in the environs of London it grows, he says, spontaneously on dry elevated heaths and commons; in such situations its produce is extremely trifling, its foliage hard and wiry, and its appearance in dry summers unpleasantly brown. In a rich moist soil the foliage retains its verdure, and becomes much longer: but, still being in its nature a small plant, it cannot be productive, consequently has no pretensions to be considered as fit for a hay-grass; it is, says he, in fact, to the *alopecurus pratensis*, what the *daisy* is to the *cichorium intybus*. In the cultivation of plants, it is well to bear the old maxim in mind,—Nature will prevail. If we force a plant on a soil or situation foreign to that in which it is constantly found, we deceive ourselves; were the *festuca ovina* to be sown in a moist soil, the grasses and other plants natural to such a soil and situation would quickly overpower it, and in the space of a year or two scarcely a blade of it would be discernible; or were we, for the sake of our sheep (taking it for granted that they are uncommonly attached to it, the reverse of which he has heard asserted by men of observation), to plough up our elevated heaths and downs, and sow them with this grass, the sheep would starve on them in dry summers. Where then, says he, is the boasted value of this grass? He thinks that Dr. Anderson errs, when, after describing its leaves as little bigger than horse-hairs, or swine's-bristles, and seldom exceeding six or seven inches in length, he says, "that it is capable of affording an immense quantity of hay, promises to be one of the most valuable grasses our country produces, and to make a most valuable acquisition to the farmer."

It appears to him applicable only to the purpose of making a fine-leaved grass-plat, that shall require little or no mowing. For which purpose it must be sown about the middle of August, in an open, not too dry situation, broad-cast, and that thickly, on ground very nicely prepared and levelled; when it has once got possession of the soil, it will form so thick a turf, as to suffer few intruding weeds, and may be kept in order with little trouble or expense.

FESTUCA *Pratensis*, the meadow fescue-grass, which Mr. Sole thinks a very excellent grass for cultivation, and yields to none but the *poa pratensis* for merit; being sweet, luxuriant, and very quick in its growth: affording rich pasture, and making good hay. It abounds in the rich meadows about Melksham, Laycock, and Chippenham; and it is found sparingly in Bathwick meadows in Somersetshire.

FESTUCA *Rubra*, the red or purple fescue-grass, which, Mr. Sole remarks, is a middle grass between the *ovina* and *duriuscula*, but which approaches nearest to the *duriuscula* in its leaves, and partakes of the virtues of both; and is, perhaps, equal to either in its properties as a grass.

FETLOCK, in *horsemanship*, the part where the tuft of hair grows behind the pastern-joint of horses; those of low size have scarce any such tuft. In working-horses, which have them large with much hair, care should be taken to keep them clean, in order to prevent the grease.

FETTER, a term applied to the chain employed to confine the feet of animals.

FEVER, in *farriery*, a disease that frequently attacks horses and other sorts of cattle, and in which there is mostly an increased quickness or velocity of the blood. Fevers may be of different kinds; but in that with which horses are the most commonly attacked, the symptoms which denote them to be afflicted are, great heat and dryness of the skin, jaws, and tongue, restlessness, the creature ranging from one end of the rack or stall to the other; his flanks beat; his eyes are red and inflamed; his tongue parched and dry; his breath hot, and of a strong smell; he loses his appetite, and nibbles his hay, but without chewing it, and is frequently smelling to the ground; the whole body is hotter than ordinary (though not parched, as in some other inflammatory disorders); he dungs often, little at a time, usually hard, and in small bits; he sometimes stales with difficulty, and his urine is high coloured; he seems to be thirsty, but only drinks little at a time and often; his pulse beats full and hard, to fifty strokes and upwards in a minute.

The first intention of cure, in this sort of fever, is bleeding, to the quantity of two or three quarts, if the horse is strong and in good condition; then give him a pint of the following drink four times a day; or an ounce of nitre mixed up into a ball with honey, may be given thrice a day, instead of the

drink, and washed down with three or four horns of any weak liquor.

Take of baum, sage, and chamomile flowers, each a handful; liquorice-root, sliced, half an ounce; and sal prunel, or nitre, three ounces: infuse the whole in two quarts of boiling water, and when cold strain it off, and sweeten it with honey.

As the chief ingredient to be depended upon in this drink is the nitre, it may, perhaps, be as well given in water alone; but as a horse's stomach is soon palled, and he requires palatable medicines, the other ingredients may in that respect have their use. Soleysel, for this purpose, advises two ounces of salt of tartar, and one of sal armoniac, to be dissolved in two quarts of water, and mixed with a pailful of common water, adding a handful of bran or barley-flour to qualify the unpleasant taste: this may be given every day, and is an useful medicine.

The following may also be given for this purpose:

Take of pearl-ashes, well prepared, one ounce; distilled vinegar one pint, or as much as is necessary for its saturation; spring-water two pints, honey four ounces; give a pint three or four times a day.

This neutral mixture, and the nitre-drink above, may be taken alternately; they are both efficacious remedies, and, in some cases, may properly enough be joined with the camphor drink.

The diet should be scalded bran, given in small quantities; which if refused, let dry bran sprinkled with water be given: put a handful of picked hay into the rack, as a horse will often eat it when he will touch nothing else: his water need not be much warmed, but should be given often, and in small quantities: his clothing should be moderate, too much heat and weight on a horse being improper in a fever; which scarce ever goes off in critical sweats (as those in the human body terminate), but by strong perspiration.

If, in a day or two, the horse begins to eat his bran, and pick a little hay, this method with good nursing may answer; but if he refuses to feed, more blood should be taken away, and the drink continued: to which may be added two or three drams of saffron, avoiding stimulant remedies: but where there is an inclination to costiveness, the following clyster may be given, and repeated every day, especially if the dung be knotty and dry:

Take of marshmallow leaves two handfuls, of chamomile flowers one handful; of fennel-seed an ounce; boil in three quarts of water to two, strain off the liquor, and add four ounces of treacle, and a pint of linseed oil, or common olive oil.

Two quarts of water-gruel, fat-broth, or pot-liquor, with the treacle and oil, will answer this purpose; to which a handful of salt may sometimes be added with advantage. This sort of clysters are more proper than those with purging ingredients.

The following opening-drink is also frequently useful in these fevers, and may be given every other day, the clysters being omitted; but the nitre-balls or drink should be continued, except on the days these are taken.

Take of cream of tartar and Glauber's salts, each four ounces; dissolve in barley-water, or any other liquor: an ounce or two of lenitive electuary may be added, or a dram or two of powder of jalap, to quicken the operation in some horses.

Four ounces of Glauber's salts, or cream of tartar, with the same quantity of lenitive electuary, may be given for the same purpose, if the former should not open the body sufficiently.

In four or five days, under this mode of treatment, horses generally begin to pick their hay, and have a seeming relish for food: though their flanks will frequently heave more than usual for a fortnight; but the temper of their bodies and return of appetite show that nothing more is requisite to complete their recovery than walking them gently in the air, and allowing plenty of clean litter to rest upon.

It is observed, that these signs, at their commencement, may indicate nothing more than simple fever; but that, when neglected, either from want of care, or necessity, the disease may become more violent, in which case its cure may be attempted, 1st, by lessening the force of the circulation by venæsection; 2dly, by relaxing the intestines, and expelling any irritating matters, which otherwise would increase the disease; 3dly, by administering such remedies as have a tendency to remove spasm from the extreme vessels, and thus restoring them to the healthy standard of action; and, 4thly, by regulating the treatment in the stable, viz. the diet, exercise, grooming, &c.

Where the inflammatory symptoms are augmented, and attended with violent pulsation, and throbbing in the arteries, so as to indicate the use of the lancet, Mr. Denny advises, that from three to six pints of blood should be taken away, and the operation repeated in a few hours, if the symptoms or state of the blood require it. He thinks, that the greatest chance of success depends on *early* bleeding; for, "in the horse, *the progress of disease is much more rapid than in man.*" After abating the force of the arterial system by bleeding, the following ball may, he says, be given:

Take of calomel, antimonial powder, of each one drachm; nitre, in powder, one ounce; treacle, enough to form a ball.

It should be washed down with two or three pints of warm oatmeal-gruel, or bran-water. And he recommends, that "the large intestines should be emptied by means of clysters occasionally given."

Take of oatmeal-gruel, three quarts; common salt, two ounces; olive oil, half a pint. Mix them.

And, says he, "eight hours after giving the ball, let the horse have the following powder, dissolved in two pints of thin gruel, sweetened with honey, and repeated every six hours, until the febrile symptoms are abated," or wholly removed.

Take of camphor, in powder, half a drachm; antimonial powder, one scruple; nitre, aniseed, of each, in powder, one ounce. Mix them.

He advises, that "the horse should have warm mashes of bran, with a small quantity of oatmeal or corn mixed in them. Hay is to be given in small quantities. The water given for drink should not be quite cold. If the mashes, &c. are refused, he must be supported by oatmeal-gruel, given three or four times daily, until his appetite returns." And that, "if there be much cough, without any mucous discharge from the nose, it would be more proper to give the mashes in a common nose-bag than put into the manger." The powder may be given in the following, instead of gruel:

Take of decoction of linseed, two pints; honey, three ounces; tincture of opium, two drachms. Mix them.

But, "when the symptoms are abated, it will only, he says, be necessary to have the grooming part well attended to, and allow of walking exercise daily. Malt, and small quantities of the best oats, should be mixed with the mashes, to recruit the animal's strength; and give the following ball every morning for ten or twelve days:

Take of coriander seeds, caraway seeds, of each, in powder, half an ounce; Peruvian bark, half an ounce; ginger, in powder, two drachms; honey, enough to form the ball."

Mr. Ryding recommends for the purpose of removing spasm from the extreme vessels, and promoting perspiration, the following:

Take of camphor, six drams; nitre, cream of tartar, of each two ounces; powder and mix them well together, and add honey, sufficient to make the whole of a proper consistence, and divide into four balls.

"One of these balls may, he says, be given every six or eight hours; his clothing should be warm, and his diet warm mashes of bran; his drink should be warm water, with a little sweet bran or oatmeal sprinkled on its surface, or warm water-gruel."

The following is recommended as a clyster:

Take of Barbadoes aloes, half an ounce; linseed tea, two quarts.

To be injected a little warm every five or six hours, according to the effects that are produced.

And where the irritation and fever continue to increase after the above treatment, a little more blood should be taken away, and the following balls be administered:

Take of purified opium, one drachm; antimonial powder, two drachms; nitre, cream of tartar, of each one ounce and a half; honey, sufficient to form the mass.

Let it be divided into four balls; one to be given every six hours.

And where there is costiveness, twenty grains of calomel may be added to each ball, continuing the clyster.

There is another sort of fever that horses are subject to, which is of the low kind, and of a more complicated and irregular nature than the former. If not properly treated, it often proves fatal.

The signs are a slow creeping fever, with languishing, and great depression of strength; the horse is sometimes inwardly hot, though cold to the feel; at other times he feels hot all over, but not to any extreme; his eyes look moist and languid; he has a continual moisture in his mouth, which is the reason he seldom cares to drink, and when he does, it is but a little at a time. He feeds but little, and leaves off as soon as he has eaten a mouthful or two; he moves his jaws in a feeble loose manner, with an unpleasant grating of his teeth; his body is commonly open; his dung soft and moist, but seldom greasy; his staling is often irregular, sometimes little, at other times profuse, seldom high-coloured, but rather pale, with little or no sediment.

When a horse's appetite declines daily, till he refuses all meat, it is a bad sign. And when the fever does not diminish, or keep at a stand, but rather increases, the case is then dangerous. But when it sensibly abates, and his mouth grows drier, the grating of his teeth ceases, his appetite mends, and he takes to lie down, which he has not perhaps done for some time, there is a more favourable prospect. A horse in this fever always runs at the nose, but not the kindly white discharge, as in the breaking of a cold, but of a reddish or greenish dusky colour, and of a consistence like glue, and sticks like turpentine to the hair on the inside of his nostrils. If this turns to a mucus, or clear, thin, watery discharge, the horse's hide keeps open, and his appetite mends, the recovery is pretty certain.

In this case of fever, it will seldom be necessary to take away any blood, except there be some fullness, inward soreness, cough, or tendency to inflammation, either of the local or general kind. The fever drink should, however, be given, with the addition of an ounce of snake-root, and three drams of saffron and camphor, dissolved first in a little spirit of wine; the quantity of the nitre may be lessened, and these increased, as the symptoms indicate.

The diet should be regular; no oats given, but scalded or raw bran sprinkled into the drinks; the best flavoured hay should be given by handfuls, and often by hand, as the horse sometimes cannot lift up his head to the rack.

As liquids are necessary, if the horse refuses to drink freely of warm water or gruel, he must be indulged with having the chill only taken off them, by standing in the stable; nor will any inconvenience ensue from this plan, but oftener an advantage; as the nauseous warmth of water, forced on horses, often palls their stomachs, and takes away their appetites, which the cold water generally restores.

Should the fever after this treatment increase, the horse feed little, stale often, his urine being thin and pale, and his dung sometimes loose, and at other times hard; should the moisture in his mouth continue, his skin being sometimes dry, and at others

moist, with his coat staring, and as if surfeited; upon these symptoms, which denote great danger, the following balls or drink may be given:

Take of contrayerva and snake-root powdered, each two drams, saffron one dram, mithridate or Venice treacle half an ounce; make them into a ball with honey, which should be given twice or thrice a day, with two or three horns of an infusion of snake-root, sweetened with honey; to a pint and a half of which may be added half a pint of treacle water, or vinegar.

Should these balls not prove successful, add to each a dram of camphor, and where it can be afforded, to a horse of value, the same quantity of castor. Or the following drink may be substituted in their stead for some days:

Take contrayerva and snake-root, of each two ounces, liquorice-root, sliced, one ounce, saffron two drams: infuse in two quarts of boiling water close covered for two hours, strain off, and add half a pint of distilled vinegar, four ounces of spirit of wine, wherein half an ounce of camphor is dissolved, and two ounces of mithridate or Venice treacle: give a pint of this drink every four, six, or eight hours.

But a more simple drink, and perhaps full as efficacious, may be thus prepared:

Take camphor one dram, dissolved in rectified spirit of wine one ounce, then gradually pour on a pint of distilled vinegar, and give for two doses. The quantity of camphor may be increased according to the circumstances of the case.

Should the horse be costive, recourse must be had to clysters, or the opening-drink; should he purge, take care not to suppress it, if moderate; but if, by continuance, he grows feeble, add diascordium to his drinks, instead of the mithridate; and if it still increases, give more potent opiate remedies.

Camphor is a very powerful and effectual medicine in these kinds of low putrid fevers, being both active and attenuating, and particularly calculated to promote the secretions of urine and perspiration. The bark, either in powder or decoction, with opiates, may be advantageously joined with it in many cases.

Great regard should be had to the staling; which if in too great quantities, so as manifestly to constantly weaken and depress the strength, it should be controlled by proper opiate or restringent remedies, or by preparing the drinks with lime-water. If, on the contrary, it happens that a horse stales so little as to occasion a fullness, and swelling of the body and legs, recourse should be had to the following drink:

Take of sal-prunella, or nitre, one ounce; juniper-berries, and Venice turpentine, of each half an ounce; make into a ball with oil of amber.

Give him two or three of these balls, at proper intervals, with a decoction of marshmallows sweetened with honey.

But if, notwithstanding this treatment, a greenish or reddish gleet is discharged from the nostrils, with a frequent sneezing; if the horse continues to lose flesh, and becomes hide-bound; if he altogether forsakes his meat, and daily grows weaker; if he swells about the joints, and his eyes look fixed and dead; if the kernels under his jaws swell, and feel loose; if his tail is raised and quivers; if his breath smells strong, and a purging ensues, with a discharge of fœtid dark-coloured matter, his case may be looked on as desperate.

The signs of a horse's recovery are the hide keeping open, and the skin feeling kindly; the ears and feet being of a moderate warmth, the eyes brisk and lively; the nose growing clean and dry; the appetite mending; the horse lying down well, and both staling and dunging regularly.

If the fever should be brought to intermit, or prove of the intermitting kind, immediately after the fit is over, give an ounce of jesuit's-bark, and repeat it every six hours, till the horse has taken five or six ounces: should eruptions or swellings appear, they ought to be encouraged, as they are good symptoms at the decline of a fever, denote a termination of the distemper, and that no further medicines are wanted.

In the state of recovery, care should be taken not to overfeed; let the diet be light, feeds small, and increased by degrees as strength is procured: as, by overfeeding, horses are apt to have frequent relapses.

Mr. Clark advises, that "a sick horse should, if possible, be removed to a well-aired stable by himself. But, as horses are very sociable creatures, and fond of being in company with others, where they are found to thrive best, another horse may be put in the same stable with him, but at as great a distance as the place will admit of, in order to let the sick one breathe a purer air. His clothing should be very moderate, and by no means girded on too tight about the breast, but only in the slightest manner, to prevent them from falling off. The rack and manger ought to be washed clean from dirt, &c. with soap and water, before the sick horse is put into the stall; all the old litter, wet or musty straw, should be removed; the fresh litter that is put under him should be spread thin, as too much of it increases the heat about his legs, &c. The rack and manger are afterwards to be kept clean, and free from the discharges that may come from the nose and mouth, as they are very apt to lick these up with their food, or by way of amusement. When the horse's breath is very fœtid, or of a bad smell, the violence of the fever still continuing, the rack and manger ought to be frequently washed or sprinkled with vinegar."

And that in "inflammatory cases, to which they are very liable, every thing that is *heating* or *irritating* is extremely hurtful, and may occasion the most untowardly symptoms, and even death."

The fevers in cattle or other animals may be treated under these regulations, attention being had to the different circumstances of the case.

As it is necessary to attend to the state of the pulse in fevers, it may be observed that, in a healthy horse, it beats, as may be felt in the arteries of the neck, about forty strokes in a minute, so that in proportion to the increase above this number, the fever is rising, and if increased to above fifty, the fever is very high.

FEWEL, any combustible substance; as wood, coal, &c. See *Fuel*.

FEY, a provincial word signifying to winnow grain with the natural wind. And also to clean wells or ponds.

FIAR, a term applied, in the more northern parts of the island, to certain averaged returns of the prices of different sorts of grain, &c.

It is stated by the author of the Agricultural Report of East Lothian, that "from time immemorial, it has been the practice of that county, and some others in Scotland, annually to fix, by public authority, fiar or average prices of each kind of grain sold within the county for ready money." With them, he says, "the average is taken only of wheat, barley, oats, and peas, because formerly these four species formed the staple produce of the county; though they now grow a great quantity of beans, no fiar prices of them have ever been struck." It is also further stated, that "the sheriff of the county, who strikes the fiars, calls before him, some time in the last week of February, or first week of March, a number of respectable tenants, and other persons who deal in corn; he requires of them an account of the quantity and price of grain sold or bought by them within the county, for ready money, from the time that the preceding crop came first into market till the day of the proof. Having obtained an account of this, be then strikes a general average for each of the four species of corn; after this he finds the number of bolls which have brought a price above that average, of them he likewise takes the average; lastly, he proceeds in the same manner with what has been sold below the general average. To each of these rates he adds two and a half per cent. and then they form what are called the first, second, and third fiars." It is remarked, that "the addition of two and a half per cent. to the real prices, must appear a singularity to strangers, who may not easily perceive either the object or the propriety of it. In the original survey of the county, the author, it is said, accounts for this in a manner very ingenious, and seemingly very just."

It is this, in his own words, "upon looking into the above-mentioned extract* it will be found, he says, that from 1627 down to 1647, the fiars were struck only once in the year; and as the record is silent as to the date, for the first thirteen years, it is impossible now to say at what period of the year these fiars were struck; but in the year 1648, the record shews that fiars were struck twice for that year, viz. at the Candlemas and the Lammas.

"In the following year, 1649, the fiars were, he observes, struck only once; but in the year 1650, and for every year down to 1675 inclusive, with the exception of the year 1665, the fiars were struck twice, viz. at the Candlemas and at the Lammas; and again, in the year 1676, the fiars were struck only once, viz. at the Candlemas; and this practice has continued uniformly down to the present time.

"It seems highly probable, he thinks, that the two and a half per cent. was first added to the Candlemas fiars for the year 1676, and was continued to be added to the fiars for every year from that period downwards.

"Upon examining the fiars for the twenty-six years, during which they were struck at the Candlemas and at the Lammas, and taking the average of both, which seems to be the fair medium price, it turns out, he says, in point of fact, that the Candlemas, with the addition of two and a half per cent. is somewhat below the above medium of the double fiars."

It is supposed by Mr. Somerville, that "this seems to account very satisfactorily for the origin of the two and a half per cent.; and it shews, he thinks, that they who first introduced it, paid considerable attention to the subject. It is evident indeed, he says, that fiars, taken at Candlemas, cannot shew the average price of grain through the year, because, in the early part of the season, it has not reached its full value. Whitsuntide would, perhaps, be the most proper time for finding a just average, and the addition made to the fiars taken at Candlemas may amount nearly to the same thing."

It is added, that "there is one objection to the mode of striking the fiars adopted in this county, which merits attention. The first price taken is the true average, the highest and lowest are only the average of the highest and lowest market-days, whereas they should express the average of the best and worst grain. A person who makes a payment according to the highest fiars, may, in fact, pay considerable more than the average price of the best grain sold throughout the season. The sales of a few high market-days, in which prices rise much above the level of the season, thrown into the general mass, may cause the highest fiars to be much above the current value of the best grain. It would seem to be a fairer mode, he thinks, to strike the fiars from the weekly prices in Haddington market; the averages of all the market-days would give the general average, while the highest prices on each market-day, thrown into one mass, and the lowest into another, would furnish the true average of the best, and of the worst grain." The fiars in this county are said to be taken with a greater degree of accuracy than in most others in Scotland.

In Perthshire, according to Dr. Robertson, they "are settled annually, in the same manner as in other counties, by a jury of traders in grain. This mode of striking the fiars, as it is called, seems, he thinks, to be improper, because the persons examined as to the prices of grain, may all have an

* An extract from the record of the fiars.

interest preponderating one way, being themselves dealers in the article, of which they fix the price; whereas were only one-third of that jury corn-merchants, another third actual farming gentlemen, and the other third farmers who pay 100*l.* or upwards of yearly rent, every class of the community would be represented in these meetings, every interest would be attended to, and every objection stated and considered: so that there was every chance, that the judgment given would rest on the broad basis of the general good of the whole county. The sheriff should continue as at present to be chairman of the jury, be umpire in case of equality of votes, and have the power of judging of any objection that may be brought forward against any of the members as a dealer in grain, which might disqualify him for holding a seat at the meeting. The time of settling these average-prices seems, he thinks, with the above writer, also to be capable of improvement. Candlemas is too early: because a small proportion only is by that time brought to market, and even that small part of the crop which is thrashed out and brought forward, is necessarily green and under value. A fair estimate can, he supposes, hardly be made of any crop before the end of March, or perhaps Whitsunday."

It is added, that "decisions are given frequently in courts of law, respecting the prices of grain, many contracts are entered into, and much meal and corn is sold, with a reference to the fiars," as well as rents and the stipends of the clergy, in many cases, received according to them. And it is supposed, that "there can hardly be a retrospective rule of equal publicity, or of equal authority, devised, or more proper for regulating these transactions; therefore too much circumspection cannot be used in the mode of establishing them, as the medium prices of every kind of grain for the respective years to which they refer."

But in order to give an idea of what have been the average prices of grain in the first district, for some years past, according to the present method of ascertaining them, a list of the fiars is given, extending from 1794 to 1804 inclusive.

CROP, 1794.

	First.			*Second.*			*Third.*		
	£.	s.	d.	£.	s.	d.	£.	s.	d.
Wheat	1	5	6¼	1	3	11¼	1	2	3¼
Barley	1	2	1¾	1	1	2	0	19	8½
Oats	0	15	2¾	0	14	10	0	14	1½
Peas	0	16	4½	0	15	6	0	14	9½

CROP, 1795.

Wheat	2	6	9	2	4	4½	2	0	4¾
Barley	1	5	2¾	1	3	10¾	1	1	11
Oats	1	1	3¾	0	19	5¾	0	18	2¾
Peas	1	0	4	0	18	9	0	17	9½

CROP, 1796.

	First.			*Second.*			*Third.*		
	£.	s.	d.	£.	s.	d.	£.	s.	d.
Wheat	1	7	2½	1	5	10½	1	4	5
Barley	1	5	0¾	1	2	8½	1	0	6¾
Oats	0	16	1½	0	14	11	0	14	0
Peas	0	14	3	0	13	5¾	0	12	8½

CROP, 1797.

Wheat	1	4	9½	1	3	0½	1	1	7
Barley	0	19	4¾	0	17	9¾	0	15	5
Oats	0	14	2	0	13	0¾	0	12	0
Peas	0	13	1½	0	12	4¾	0	11	8

CROP, 1798.

Wheat	1	3	8	1	2	8	1	2	0
Barley	0	19	5¼	0	18	6	0	17	9½
Oats	0	15	0½	0	14	8	0	14	0¼
Peas	0	12	10	0	12	5	0	11	11¼

CROP, 1799.

Wheat	2	3	9	2	0	9¾	1	14	8
Barley	1	14	8	1	11	11	1	9	2
Oats	1	12	4½	1	8	7½	1	5	0½
Peas	1	18	1½	1	13	1½	1	8	6¼

CROP, 1800.

Wheat	3	7	3¾	3	3	1¾	2	15	3½
Barley	2	12	5	2	6	11¼	2	2	4¼
Oats	1	18	11½	1	15	8	1	10	9¼
Peas	2	6	2¼	2	1	6	1	16	8¾

CROP, 1801.

Wheat	1	17	5¼	1	15	1	1	12	4
Barley	1	8	5	1	6	1½	1	4	4
Oats	0	18	7¼	0	17	4¼	0	15	11
Peas	0	17	10¾	0	16	10¾	0	16	0¾

CROP, 1802.

Wheat	1	12	1½	1	8	8½	1	6	11¼
Barley	1	0	8¼	0	19	2¾	0	17	1½
Oats	0	16	6½	0	15	4¾	0	16	4¾
Peas	0	16	1½	0	15	6	0	15	0

CROP, 1803.

Wheat	1	7	5½	1	5	11¾	1	4	7½
Barley	0	19	2¾	0	17	10¼	0	16	6½
Oats	0	18	6	0	16	11½	0	15	7
Peas	0	17	10	0	16	10	0	15	10¾

CROP, 1804.

Wheat	2	6	1¼	2	2	4¼	1	15	7
Barley	1	13	3½	1	11	6¼	1	9	5
Oats	1	1	2½	0	19	8	0	18	5
Peas	0	19	2¼	0	17	11½	0	16	11¼

These statements afford, probably, the best view of the prices of grain in the northern parts of the island for these years that can be furnished.

FICK, a term signifying to struggle with the legs, as a cow in the tie, &c.

FICKLETOW, a provincial term signifying the fore-tackle, or carriage which supports the plough-team.

FIELD, a piece of ground inclosed by fences, whether for tillage or pasture.

Fallow-Field, a term applied to a common field that is occasionally fallowed.

Field-*Husbandry*, any kind of husbandry performed in a field, whether in the state of tillage or grass. See *Husbandry*.

Field-*Scabius*, a perennial weed common among corn. It is rough and hairy all over. The stalk is upright, and often a foot or a foot and a half high, spotted, and branching. The lower leaves are oval, and indented about the edges. Those which grow on the stalk are divided, and of that sort which botanists call pinnated. The flowers are blue, and of the compound kind, consisting of a considerable number of small ones, each divided into four parts, and having one seed under them. The taste of the plant is a disagreeable bitter.

Field-*Well*, a small sort of artificial watering-place for cattle, in fields. See *Drinking-Pool* and *Pond*.

FIG, a name given by *farriers* to a sort of wart on the frush, and sometimes all over the body of a horse. The figs that appear on the frush or sole, often discharge a malignant stinking humour, which is very difficult to cure.

It is observed, that their seat is for the most part at the top or side of the frush; but, when they are suffered to grow old, or are dried up with strong ointments, they take another course, and spread to the corner of the heel. Like most other excrescences of that kind, they are only to be cured by extirpation. Therefore, if the figs be on the side of the frush, pare away so much of the root as may give room to reach the sore with a fleam or a lancet; then cut the sole about the fig, and take them clean out, avoiding as much as possible to wound the large blood-vessels. Let the first dressing be made of dry hurds, to stop the bleeding; and, if it require a styptic remedy, apply such as are proper for stopping the bleeding: two or three days after, remove the dressing, and, if any part of the excrescence be left, destroy it, by applying ægyptiacum spread on pledgets of tow, mixing with every ounce of the ointment half a drachm of arsenic or corrosive sublimate, enlarging or diminishing the quantity of the latter as you find the horse able to bear it, or the circumstances of the sore may require; and then heal up the sore with a good digestive, &c. And it is added, that where the fig has its insertion into the sinewy or cartilaginous substances in those parts, you must take up the sole, and, if any part of the cartilage be corrupted, cut it off with a sharp instrument. If the bone be ulcerated and carious, touch it with a hot iron, and then dress it with pledgets dipped in tincture of myrrh with aloes, or with warm turpentine and honey of roses, until the bone be covered. Afterwards heal up the sore with some good digestive application.

FIGGING, in *horsemanship*, a term applied to a well-known stable-practice among horse-dealers. It is to thrust a "*corn*" (as it is phrased) of ginger into the fundamentof a horse, or vagina of a mare, the instant of being led out to shew, for the purpose of creating irritation, and causing them to elevate their tail, which is thereby usually cocked up in a strange manner. The dealers, with but few exceptions, permit servants to shew horses without having them previously figged under a forfeit. It is, however, too stale an artifice to impose upon a person of judgment.

FIG-*Wort*, a perennial weed common in pasture-grounds. The roots consist of oblong knobs. The leaves are heart-shaped, cornered, and placed on foot-stalks. The flowers in general resemble those of the crowfoot, but differ somewhat from them in having the cup divided into three parts only, the petals being about eight in number, and narrower. This low plant runs very much by the roots, and chokes all others which are near it. It is sometimes termed *pile-wort*, or *lesser centaury*.

FILLER, a term provincially applied to the horse which is fastened immediately to the cart, and which supports the shafts. It is mostly written thiller. See *Thiller*.

FILLY, a mare, or female young animal of the horse kind.

Filly *Foal*, a mare, or female foal.

FILM, in *farriery*, is an opacity of the transparent cornea, erroneously supposed by some to be capable of removal by an operation. See *Eye*.

FIMBLE-*Hemp*, a term applied to early ripe hemp.

FIN, a term applied to a sharp or cutting plate, fixed upon the sock or coulter of a plough.

Fin, a term provincially applied to the troublesome weed called rest-harow.

FINCHED, a term signifying streaked with white in cattle.

FINCH-*Backed*, streaked on the back with white, as cattle.

FINE-BENT *Grass*, the name of a species of grass found in great plenty on the best sheep-pastures. See *Grass*.

FIRE-*Blast*, an accident to which hops are very liable. See *Hops*.

Fire-*Bote*, a quantity of wood bound up for fuel.

FIRING, in *farriery*, an operation performed on different parts of the horse. It is done in this manner: when the firing-iron is red hot, the farrier applies the thinnest part to the horse's skin, in one or more places, according to the nature of the disease. This operation is chiefly necessary after strains and other accidents, which may occasion a long continued weakness, or where there is a fullness, and the part is grown hard and callous, especially about the joints, sinews, and those parts composed of a great number of fibres or threads,

which lie so deep and close together, that nothing but what is of a powerful nature is sufficient to affect them.

This remedy, it is said, sometimes proves beneficial, when all other means have been found ineffectual. In firing about the sinews and nervous parts, great care is however to be taken not to go too deep at first, but by gentle repeated razes or lines, till they come to a pale red colour; for, if the fire once touches the sinew, it will make the horse go lame as long as he lives: the iron ought to be drawn pretty close together on each side the joints or sinews, following the course of the hair, without making cross lines, which are of no use in these parts, and are apt to disfigure the horse afterwards.

When a disease in the more fleshy or deep seated parts requires firing, the skin ought to be pierced deeper, in order to draw away a sufficient quantity of matter from the part: the operation ought to be performed upwards, to prevent any ulcerous disposition attending it: and in such cases little soft dossils of tow, dipped in warm basilicon, and spirit of wine, may be thrust gently up into the orifices. The firing instrument, or knife, ought to be somewhat rounded on the edge, and gradually thicker to the back, so as to keep the heat of the fire for some time; it should be rubbed clean, that no dirt or ashes may stick to it, and not used until the flaming redness is in part gone off. All the seared parts ought immediately to be bathed with spirits of wine; and where nothing else is required to complete the cure, the place need only be anointed with oil and bees-wax melted together.

It is observed by Mr. Lawrence, who seems no great advocate for the practice, that "its use is said to be, to discuss swellings by promoting absorption, and in contracting the skin to form a constant bandage round the sinews, both during the cure and ever afterwards. What strikes him as the most important benefit in the measure is, the support it is apt to give to the parts *after the cure.* The necessary precautions respecting the operation upon the back sinews are, that the parts to be fired be not in a state of inflammation, that no cross lines be made on any account, that the fire be only given deep enough to have sufficient effect upon the skin, without burning the sheaths of the tendons; that no person be suffered to mount the horse, but that he be turned to grass, as soon as convenient, for at least three months. The windgalls, he thinks, should be let out previous to firing. When the operation is intended to be very effectual, the lines are drawn thick around the leg, from the bottom of the pasterns almost up to the knee. He should conceive that fewer lines would make a firmer bandage. He must remark also, he says, that a man's common sense must naturally depict the operation of cauterizing as a very delicate one, and by no means within the power of every heavy-handed smith." He adds, however, that, "when the pastern joints are exceedingly full and swelled, the legs gorged, the tendons enlarged, in fact the parts indurated, there seems an almost absolute necessity for blistering and firing, since no other measures will be sufficiently discutient." And he apprehends, with respect to race-horses, that "there are few but must be shortened in their speed, if fired to any effectual purpose; and that, then, it is a chance but that a force sufficient again to start the tendon must also be adequate to loosen or burst the bandage."

In the Veteriuary College, the practice in firing, is, to draw the lines vertically round the affected limb; the contraction of the skin in that direction forming, it is supposed, the most effectual and uniform bandage on the part.

Firing, in *horsemanship*, a term applied to a certain cruel discipline of the whip, used by horse-dealers, in order to terrify horses, and thereby arouse spirit or mettle in them. It is a barbarous and brutal practice employed to make the horse appear lively, on being approached or spoken to.

Firing-*Iron*, in *farriery*, a piece of iron about a foot long, one end of which is made flat, and forged like a knife, the back of it being half an inch thick, and the edge about the eighth of an inch; it is used for the purposes mentioned in the above article.

FIRLOT, a measure of grain used in the northern parts of the island, which differs in size, according to Mr. Somerville, in his Agricultural Survey of East Lothian, in the proportion of 21, 25 to 31. Wheat, rye, beans, and peas, are, he says, sold by the small firlot; malt, barley, and oats, by the large one. Four small firlots are, he says, 4.087276 Winchester bushels: four large ones 5.96263 bushels Winchester. Four firlots make a boll. See *Weights* and *Measures.*

FIR-*Tree*, an evergreen tree, used for timber, which is very common on mountainous and barren places, especially in the colder climates. It has single leaves, for the most part, produced on every side of the branches.

These trees are raised from seeds taken out of their cones. The method of getting the seeds out is, either by exposing the cones to a gentle fire, or by soaking them for a short time in water, which will cause their cells to open, and readily emit the seeds. The former method is the best, provided they are not exposed to too great heat. But this ought not to be done until you are ready to sow them. Plants of this kind should always be raised in a nursery, where they may be protected from the birds, otherwise they will be in danger of being destroyed, when they first come up: for as they bring up the husk of the seed on the top of the plant, the birds in picking it off are apt to break off the plant, whereby a whole bed may be destroyed in a few hours, if they are not carefully guarded from them.

The best time of sowing the seeds is about the latter end of March or the beginning of April, on a bed of light earth, covering them about half an inch deep with the same sort of earth. In this bed the plants should remain until the following spring, when there should be a number of beds prepared in the nursery to receive the seedling plants; and about the beginning of April they should be transplanted into them, at the distance of six inches from row to row, at three inches asunder in the rows. If the

season should prove dry, it will be proper to water the plants every week once or twice, according to the warmth of the weather; and the beds should be covered with mats to screen the plants from the sun and drying winds, until they have taken good root; after which time they require no further care, but to keep them clear from weeds. In these beds the plants may remain two years; at the end of which time they may be transplanted into an open spot of ground, as their roots will in that time meet quite over the beds.

The distances which the trees should be planted in this nursery should be four feet row from row, and two feet asunder in the rows.

When they are planted out, if the season prove dry, they should be watered, to settle the earth to their roots; and if this is repeated three or four times, when the season continues dry, it will greatly promote their taking new root, and secure them from the injuries of the drying winds. In this nursery the plants may remain two or three years, according to the growth they shall have made; but during this time the ground between them should be constantly kept clean from weeds, and dug between the rows every spring; in doing of which, care must be taken not to cut or injure the roots of the plants: this is all the culture they will require during their continuance in the nursery: and, when they are transplanted into the places where they are to remain, the necessary care to be taken is, in taking them up, not to injure or cut off their roots, and to let them be as little time out of the ground as possible; and, when they are out, to guard their roots from the drying winds. The surest time for removing of these trees is about the beginning of April; though they may be, and often are, removed with success at Michaelmas, yet the spring is the more sure season, especially in moist land.

Mr. Miller observes, that most of the kinds of firs may be removed at the height of six or seven feet; but that those of two feet high are much better, and will in a few years generally get the better of those set out when taller.

It is observed by Dr. Anderson, in the third volume of his Essays, that the improvements that have been made in the northern parts of Scotland, by means of large plantations of Scotch fir, upon the barest moors, and in the bleakest and most inhospitable situations, are now well known; and afford the clearest demonstration of the utility of such enterprises, when judiciously conducted: and though it is admitted that the Scotch fir is among the most perishable and least valuable kinds of wood that can be reared, and therefore sells every where at a very moderate price; yet, as the expense of rearing that tree is very trifling, the returns have been in all cases so abundant, as fully to satisfy the persons who have made these plantations; even when no other circumstance but the direct income that has arisen from these plantations themselves has been taken into the account. But when the collateral advantages are likewise adverted to, the improvement occasioned by these appears, he says, to be infinitely great. In the neighbourhood of such plantations, houses can be reared at so little expense, and the roofs are so much straighter and better than ordinary, as to induce settlers to make their houses much neater and more commodious than in other places; rails, and other kinds of dead fences, can be so easily obtained, that poor people are first enabled to have good well-fenced gardens, and then commodious inclosures of larger extent; the branches afford fuel to the settlers, which greatly adds to the comforts of their situation: cutting and manufacturing the wood into various kinds of utensils furnishes employment to many persons; population is thereby augmented; and, with an increase of population, its necessary consequence follows, a desire for land to produce the necessaries of life, and a consequent increase of rent to the proprietor. Like the settlers in America, these new settlers, in the desert wastes of Scotland, cultivate and improve the soil, as the trees are gradually cleared from it. In this way, Mr. George Dempster, who will long be respected in Britain, at this moment, he observes, sees fields rapidly converting into cultivated ground on his estate, and yielding to him ten or twelve shillings per acre rent, not only without any expense to him, but after having derived a considerable profit from the sale of woods of his own planting, which grew upon land that five-and twenty years ago was not worth to him, above two-pence per acre, and which might have remained in that state perhaps for ages yet to come, had it not been planted at all. It is by a judicious management of this kind, that men of landed estates, by a little foresight, and with much profit, find themselves enabled to furnish both employment and subsistence to a numerous people, who must otherwise have either remained in a destitute situation, or have abandoned a country which did not properly provide for their accommodation. It is further remarked, that a plantation of Scotch firs can be made at much less expense than any other kind of tree in the northern parts of Scotland; because the young plants can be afforded at a smaller price than any others. In Aberdeenshire, where planting is so general as to have become a sort of occupation, fir plants of two years old (and above that age no experienced planter will ever buy them) sometimes, he says, sell at the very low rate of four-pence per 1000, consisting of twelve hundred; and they seldom exceed eight-pence; on an average sixpence, or one half-penny per hundred: and there are men who make a business of making plantations, who will undertake to complete the whole inclosing and planting, at the distance of one yard from each other, and uphold them for five years, (that is, supply any deficiencies that may be observed,) at the rate of from ten to thirty shillings per Scotch acre (four Scotch are equal to five English acres nearly), according to the size of the inclosure, and the nature of the fence. In all cases of this kind, it is supposed that plantations are of thirty or forty acres, or upwards; for where the inclosures are smaller, the expense of inclosing is proportionally augmented. The charge is thus not only made moderate, but the total expense a man is to incur can

be ascertained before he begins; which prevents him from being involved in unforeseen difficulties.

It is found, he asserts, by experience, that there is scarcely any soil so bad, or any exposure so bleak, where the fir-tree will not live, if the plantation be of sufficient extent, and not upon the very summit of high peaked hills. They do not, indeed, bear the sea air very well, where they are much exposed to the severity of its blasts, nor is the wood ever of a good quality, or the tree long lived, upon clayey soils. Several persons in tho south of England have found that the pine-aster bears the sea blast much better than any others of the fir tribe; which is a discovery of great importance, and will no doubt be attended to by improvers. The spruce fir, however, will bear a still more exposed situation than the Scotch fir; and, after a few years from the time of planting, it shoots up with still greater luxuriance. But the cones not being to be had in equal abundance, and the plants being more difficult to rear, they are sold at a much higher price, usually about six shillings per thousand, fit for planting out. The silver fir, in a good soil, prospers well, and is a beautiful tree, on account of the depth of its shade; but the price of the plants is too great to admit of large plantations of them being made with advantage. But, wherever the situation is bleak, and much exposed to strong blasts of wind, the plantation must not only be of considerable extent, if you expect the trees to thrive, but the trees must be planted very close together, so that each plant stands at the distance of from two to three feet at most from each other: the more exposed the situation, the closer they must be; for it is observed, that, until the branches intermingle, and thus serve to give a mutual support to each other, the trees never begin to advance with vigour. Where the plantations are thus thick, there is a necessity for beginning to thin these out at a pretty early period: so that after the tenth to the fifteenth year from the time of planting, men must be constantly employed in thinning these plantations; and there are very few situations indeed in which these thinnings cannot be disposed of to advantage, or such plantations formed.

It is also observed by Mr. South, in the sixth volume of the Letters and Papers of the Bath Agricultural Society, that though he does not think the Scotch fir in this country can ever equal the yellow deal from the Baltic, yet that it may be worth propagating, as of useful purpose in ordinary buildings. The dryer the ground on which this timber grows, the slower is its progress, but the closer are its pores, and the more superior its quality. When planted in rich land, these trees will shoot three or four feet in a season, and equal, if not surpass, the abele in growth. His plantations, though chiefly confined to chalky banks, in a north-west exposure, evince, that, when once rooted, few obstacles will prevent a profitable progress. From observing the mistakes of others in endeavouring to ornament their naked downs too suddenly, he learnt, he says, the necessity of planting firs, when a foot high only, and by opening the ground some time before, inverting the turf at the bottom of the holes, and throwing the mould upon it in hillocks, to meliorate, his plantation succeeded well; for though the soil is scarcely six inches deep, the firs set in 1766 are now thirty feet high, and from two feet six inches to two feet in circumference, at four feet from the ground; some few planted at the same time, in a deeper soil and warmer situation, are now above three feet round. Spruce firs planted in 1766, likewise in a tolerably good soil, are now forty feet high, and from two feet ten inches and a half to three feet round. He has seen plantations which far surpass either of these in growth, but they occupied ground infinitely more valuable. See *Pine*.

The tops or shoots of the fir-tree have sometimes in a scarce season been employed for the purpose of feeding cattle.

FISH-PONDS, pits or reservoirs of water applied to the purpose of breeding and keeping of fish.

In favourable situations, and where the lands are under the direction of the owners, it may sometimes be convenient, and afford pleasure as well as a good profit, to have these sorts of ponds constructed, not merely for containing and preserving the fish, but in order to breed and rear them. And in deep vallies, and slight depressions between hills, where there are rivers or waters, they may often be formed with little trouble or expense. And different ones may often be made on the same line, the head of one constituting the bottom of that above it. The extent of them must be regulated by the nature of the situation, and the supplies of water that can be procured. In situations of this nature, the principal expense consists in constructing the banks or heads across the vallies, for keeping up the waters, and providing them with suitable sluices, which, where the land is of the loamy or clay kind, may be cheaply effected in the manner that earth works are usually performed. The foundations being laid sufficiently deep, and the earthy materials well applied by proper puddling and ramming, in the way of making embankments. The heights and strength of the dams or heads being regulated by the nature of the situations, and the quantity of water that is to be dammed up. The slopes should be the greatest which are next the waters. There must also be diverting channels for taking off the superabundant waters in time of floods, which may be formed along the sides; the sluices being placed in the lowest parts, and be well made of seasoned oak, and tightly rammed in with the earthy materials. Ponds of this sort are no small improvement of watery and boggy lands, many of which are fit for no other use. In making of a pond, its head should be at the lowest part of the ground, that the trench of the flood-gate, or sluice, having a good fall, may not be too long in emptying. The best method of making the head secure, is to drive in two or three rows of stakes, about six feet long, at about four feet distance from each other, the whole length of the pond-head, the first of which should be rammed at least four feet deep.

If the bottom be false, the foundation may be laid with quick-lime, which, slakeing, will make it as hard as a stone. Some, however, lay a layer of lime, and another of earth dug out of the pond, among the piles and stakes; and when these are well secured, drive in others, as they see occasion, ramming in the earth as before, till the pond-head be of the height designed. Puddling or treading in moist clay may, however, in most cases, be fully sufficient.

The dam should be made sloping on each side, leaving a waste to carry off the over-abundance of water in times of floods or heavy rains; and as to the depth of the pond, the deepest part need not exceed six feet, rising gradually shallower towards the sides, for the fish to sun themselves, and lay their spawn. Gravelly and sandy bottoms, especially the latter, are best for breeding; and a rich soil with a fine rich water, as the washing of hills, commons, streets, sinks, &c. is best for fattening all sorts of fish. For storing a pond, carp is to be preferred for its goodness, quick growth, and great increase, as breeding five or six times a year. A pond of an acre, if it be a feeding and not breeding one, will every year feed two hundred carp of three years old, three hundred of two years old, and four hundred of a year old. Carp delight in ponds that have marl or clay bottoms, with plenty of weeds and grass, whereon they feed in hot months.

The expense of forming heads or dams of the above nature must differ according to circumstances, but may mostly be executed at from one to two or three shillings the cubical yard.

The ponds should be drained every three or four years, and the fish sorted. If it is a breeding one, the smaller fish are to be taken out to store other ponds with, leaving a good stock of females, at least eight or nine years old, as they seldom or ever breed before that age. In feeding ponds, it is best to keep them pretty nearly of a size.

Where carp is the fish mostly raised, it is often the case to have different ponds; as one for spawning the fish, and containing them in the same summer, as they commonly spawn from May to July; another for nursing the young fry in, into which they should be put about April, choosing a day that is fine and sunny for the purpose, being prevented as much as possible from coming to the sides, and being destroyed. They may be continued in this about two years, or till they are become from four to six inches in length. And a third or main pond for containing the grown fish, as those from eight inches to a foot or more in length.

The stocking of these several ponds are advised by Mr. North, in the Annals of Agriculture, to be performed in this manner: For each acre of the first kind "three or four male carps, and six or eight female ones." The proper sort being "those of five, six, or seven years old, in good health, with full scale, and fine full eyes, and a long body, without any blemish or wound." The ponds being previously well cleaned from all sorts of destructive fishes or other animals; such as "perch, pike, eel, and trout; also the water-beetle, and newts or lizards."

The ponds that have warm sunny aspects, are open, and have soft water, are the best suited for this use; every sort of water-fowl being kept from them.

For the nursing ponds, a thousand or twelve hundred may not be more than sufficient to the acre. And for the principal ponds, it is necessary that one should be added to every square of about fifteen feet, as much depends on their having abundant food and plenty of room. And that for these, the spring and autumn are the most proper periods. By some three to a square perch are directed. And in stocking extensive ponds, as those of three or four acres, or other waters, where carp is the sort of fish made use of, they may be put in, in the proportion of three hundred to the acre; but in those that are smaller, in a less proportion. Also in re-stocking them after a few years, about four hundred to the acre.

But with respect to tench, where the ponds are proper for them, in stocking them at first the proportion may be rather more, and in re-stocking a great deal more, as in that of seven or eight hundred to the acre.

In respect to perch, as that sort of fish breed rapidly in the first stocking, six hundred to the acre may be plenty. In Berkshire it is the practice, where the ponds are numerous, to stock with carp and tench in the proportion of one hundred to the acre, the fish continuing in them about four years. But in the management of Sir Henry Featherstone, in Sussex, in an extensive pond of sixteen acres, the custom is to stock in the proportion of twelve hundred carp and tench, or in that of seventy-five brace to the acre; in which they are said to succeed very well. Where there is no pike, too great a proportion should be guarded against, as abundance of food is a material point with these sorts of fish.

There is a great difference in waters, in respect to the raising of fish. Some being better suited to some sorts than others. Where the waters are rich, and white in their colour, they are more suited to carp; while those that are more thick and muddy, are better adapted to tench. Perch are found to answer well in almost any. Eels succeed best where there is a spring, and much deposition of muddy matter, without the ponds being too large. Pike should not on any account be kept in ponds with carp and tench, but in separate breeding ponds, where the small fry is large, and not wanted for stocking with.

Those most attended to in the view of profit are carp, tench, and perch, and sometimes eels. However, perch and eels should not be admitted together in thinly-stocked ponds, as they devour young fry largely: in extensive ponds, carp and tench do well together, but in other cases the former deprives the latter of his food, being so much more powerful. Carp rarely affords much profit in small ponds, but tench answers well in those of almost any size. Carp,

perch, and eels, succeed tolerably well together, and also tench with the last. Carp oftener injure themselves with breeding than tench, but it sometimes also happens with the latter. In small sized ponds, it would perhaps be the best practice to keep the carp and tench distinct from each other.

In feeding of fish in ponds, the best food is either malt boiled, or fresh grains; in this way carp may be fed like capons, and tench will feed as well. The care of feeding them is best committed to a gardener or servant, who should be always at hand. When fed in a stew, any sort of grain boiled, especially peas, and malt coarsely ground, are proper food; also the grains after brewing, while fresh and sweet; but one bushel of malt not brewed will go as far as two of grains.

It is probable that, in small ponds, fish of different kinds, as carp and tench, should, as just observed, be kept separate; but in large ponds this need not be attended to.

In regard to the quantity of produce or profit that ponds of this nature are capable of affording, it must obviously differ very materially in different situations; and but few facts have yet been stated from which conclusions can be drawn. It would lead to much useful information on this point, if the annual increase in weight of different sorts of fish, in different periods of their growth, and under different circumstances of both soil and water, were carefully ascertained. But we have too few statements of this sort, to rest any thing upon. Mr. Loveden, of Berkshire, however, remarks in Mr. Young's Annals, that a pond of three acres and a half, drawn after three years stocking with stores of one year old, afforded of carp 195lb. weight; of tench 230lb.; in the whole, 425lb. which sold for 20*l.* 10*s.* or nearly 2*l.* 6*s.* per acre, per annum. And that the same pond stocked with tench only, when drawn three years afterwards, produced about 26*l.* Supposing, therefore, that in a pond which supports 2400 fish, half a pound each be gained annually, it will be a 1200lb. weight, which, at 6*d.* per pound, affords 30*l.* and for fifteen acres, 40*s.* per acre: and when at 9*d.* the pound, 3*l.* for the acre. As there is little trouble in this sort of farming, such profits should not be overlooked in particular situations. It is stated that, in the above district, the price when sold by the pound is one shilling for tench, and ten-pence for carp. And that this is the best mode of disposing of them. But that when sold by the number, they are measured from the eye to the tail, and sold in the manner stated below.

		£.	s.	d.
Tench under 12 inches	-	3	0	0
12 ——	-	5	10	0
14 ——	-	7	0	0
Carp under 12 inches	-	5	0	0
14 ——	-	6	10	0
16 ——	-	8	0	0

Much remains to be effected in regard to stocking, and other parts of the management of ponds, before the greatest possible profit can probably be derived from them. In cases where they are filled by river streams, the practice of feeding them can perhaps seldom be necessary; but under other circumstances of the ponds, it may be a beneficial mode of management. The substance mostly made use of for this purpose, besides those noticed above, is a sort of light bread, formed from coarse wheaten flour, and the mealy part of the potatoe. Other similar substances may also be employed. In severe frosty seasons, in small ponds, much destruction of the fish is often produced from the want of air, on account of the ice remaining unbroken; care should therefore be had to have this done daily in such seasons.

It is remarked by Mr. Marshall, that though ponds for fish occur on almost every side of the metropolis, it is only in the adjoining southern districts of Surry and Sussex, that the system of fish-breeding, with a view of profit, can be said to be established. "There," says he, "fish-pools have been, and still are formed, with the view of letting them to dealers in carp and other pond-fish: or of stocking them, and disposing of the produce, as an article of farm stock;—as pigs, rabbits, poultry, or pigeons."

But that, "in a general view of the kingdom, fish-pools can scarcely be considered as an object worthy of consideration, in the improvement of landed estates. Yet, he thinks, there are situations in which they may be formed with profit:—as in the dips and hollows of extremely bad ground; especially if waters, which are genial to any of the species of pond-fish, happen to pass through them, or can be profitably led to them. Even where the water, which can be commanded, is of an inferior quality, a profitable breeding pool may be formed, to stock ponds of a more fattening nature."

It seems, however, not improbable, but that when the nature and management of this sort of stock becomes more perfectly understood, fish-ponds may afford not only an excellent amusement, but considerable benefit in the family use, as well as profit in the sale of the fish, in many situations where they have hitherto escaped the notice of the proprietor or farmer.

FISHERY, a river, or extent of water, where fish is taken for the purpose of profit. These are chiefly for salmon. See *Salmon-Fishery*.

FISTULA, in *farriery*, a deep, narrow, and callous ulcer, generally arising from abscesses. It is a disease which, in the horse and other animals, may be termed a sinuous ulcer, differing from the true sinus in being of a much longer duration, in having its internal surface and external aperture indurated, and discharging from the opening a fluid of a sanious nature. All the fleshy parts of animals are liable to this disease, but, in the horse, more particularly, in the *withers* and the *poll*.

It is produced by blows, by bruises from the saddle, and whatever causes inflammation; also by the presence of extraneous substances. Suppuration taking place, and the matter finding no proper outlet, it insinuates itself gradually into the cellular mem-

brane, where, occupying the interstices of the muscles, and taking various directions, it forms what are termed *fistulæ*, or *pipes*, conveying a constant sanious discharge. Injuries of the bones also sometimes produce fistulæ.

In curing of this disease it is requisite, in the first instance, to ascertain the direction it pursues, and whether it materially interferes with any of the larger blood-vessels, so as to render a full incision into the parts a matter of too much hazard to be attempted. When secure from any danger of this nature, the most effectual practice is, to lay the fistula, or fistulæ, when more than one, so thoroughly open, as to have a complete view of their internal surfaces. It is not, however, necessary in simple sinus, where the matter is in a healthy state, and requires only a sufficient passage; but in cases where the discharge, by having been long detained, indurates and corrodes the contiguous parts. As the means fully adequate to remove the former avail little in the radical cure of the latter, a more severe practice of course becomes necessary.

When the fistular cavities have been fully laid open by the knife, they should be dressed with powerful caustic compositions, until the unsound parts slough away, and the wound presents a healthy appearance. Cleanliness, with more mild applications, should now be had recourse to, taking care that the wound be not closed before the cavities are properly and uniformly healed. See *Withers*.

FISTULAR, an epithet applied by farriers to such ulcers as have but small openings. It is also a term applied by botanists to such leaves and flowers as are tubular, or that resemble a hollow pipe. It is often written *fistulous*.

FITCHES, a term signifying vetches. See *Vetches*.

FLAG, a term sometimes applied to the turf, or surface of the ground, which is pared off for burning. It also signifies the furrow slice of ley lands, when under the plough. See *Paring* and *Burning*.

Water-FLAG, a plant of the aquatic weed kind, useful for the purpose of manure, when in large quantities.

FLAIL, a well-known implement of husbandry, used in threshing all sorts of corn. See *Threshing-Machine*.

FLANKS, in *farriery*, the sides of a horse or other animal. In a strict sense, the flanks of a horse are the extremities of his belly, where the ribs are wanting, and below the loins. They should be full, and at the top of them on each side there should be a feather; and the nearer those feathers are to each other, so much the better: but if they be as it were within view, the mark is said to be excellent. The distance between the last rib and haunch bone, which is properly the flank, should be short, which is termed well-coupled; such horses are most hardy, and will endure labour longest. If a horse have a flank full enough, you are to consider whether it be too large; that is, if over against that part of the thigh called the stifle, the flank falls too low; for in that case it is a great advance to pursiness, especially if the horse be not very young.

A horse is said to have no flank, if the last of the short ribs be at a considerable distance from the haunch bone; although such horses may for the time have very good bodies, yet when they are hard laboured, they will lose them. A horse is also said to have no flank when his ribs are too much straightened in their compass, which is easily perceived, by comparing their height with that of the haunch bones; for they ought to be as high and equally raised up as they are, or be very little less, when the horse is in good case. A horse is likewise said to have little flanks, to be badly bodied, or to be *gaunt-bellied* and *thin-gutted*, when his flank turns up like a greyhound, and his ribs are flat, narrow, and short.

A well-flanked horse is one that has wide and well-made ribs, and a good body.

FLAX, the name of a plant cultivated equally for the covering of its stalk and its seed; the former being used in making linen, and the latter for oil. The stem of the plant, which is round and hollow, grows to the height of about two feet, and then divides into several branches: these are terminated by blue flowers, consisting of five petals, and are succeeded by capsules divided within into ten cells, in each of which is enclosed a bright, slippery, elongated seed. Its leaves are long, narrow, sharp-pointed, and placed alternately along the stem and branches.

The most proper soil for flax is a deep free loam, such as is not liable to become too much charged with moisture, or too dry; but which has been rendered fine by tilth, such as those situated in a valley bordering upon water, or as is thrown up by rivers. If there be water at a small depth below the surface of the ground, it is thought, by some, still better, as is the case in Zealand, which is remarkable for the fineness of its flax, and where the soil is deep and rather stiff, with water almost every where, at the depth of a foot and a half or two feet underneath it. It is said to be owing to the want of this advantage, that the other provinces of Holland do not succeed equally well in the culture of this useful plant; not but that fine flax is also raised on high lands, if they have been well tilled and manured, and if the seasons are not very dry.

It is remarked, in the Letters of the Dublin Agricultural Society, that moist stiff soils yield much larger quantities of flax, and far better seed, than can be obtained from light lands; and that the seed secured from the former may, with proper care, be rendered full as good as any that is imported from Riga or Zealand. M. du Hamel, however, thinks that strong land can hardly yield such fine flax as that which grows on lighter ground.

It is remarked by Mr. Donaldson, that flax is sown after all sorts of crops, but is found to succeed best on lands lately broken up from grass. In Scotland, the most skilful cultivators of flax, he says, generally prefer lands from which one crop of grain only has been taken, after having been several years in pasture. When such lands have been limed or marled, immediately before being laid down to grass, the crop of flax seldom or never misgives, unless the season prove remarkably adverse.

In regard to the choice of seed, he says, that which

is of a bright brownish colour, oily to the feel, and at the same time weighty, is considered the best. Linseed, imported from various countries, is employed. That brought from Holland is, however, in the highest estimation, as it not only ripens sooner than any other that is imported, but also produces greater crops, and flax of that quality which best suits the chief manufactures of the country. American seed produces, in common, fine flax; but neither the quantity of flax, nor of the pods, provincially the "bolls," which contain the seeds, is so large as the produce from Dutch linseed. Riga seed yields a very coarse sort of flax, but a greater quantity of seeds than any other. It is common in some parts of Scotland to sow seeds saved from the crop of the preceding year, especially when that crop was raised from seed imported from Holland. The success of this practice is found to depend greatly on changing the seed from one sort of soil to another of an opposite nature; but the saving in the expense of purchasing that sort of seed, in place of what is newly imported from Holland, is so inconsiderable, and the risk of the crop misgiving so much greater in the one case than in the other, that he thinks those only who are ignorant of the consequences, or who are compelled from necessity, are chargeable with this act of ill-judged parsimony.

The quantity of seed used, varies in different places; but from two bushels, to two bushels and a half, the English statute acre, is the ordinary allowance. In determining the proper quantity necessary for the acre, it is requisite, he says, to pay great attention to the condition of the land. When the land is rich and fertile, and the season so favourable that it can be got thoroughly pulverised, if too much seed is sown, the crop is in great danger of lodging; and when that happens, particularly before the pods are formed, the flax proves inconsiderable in quantity, and very inferior in quality.

It is observed, that the ordinary season of sowing flax-seed is from the middle of March to the middle or end of April, but the last week of March, and the first ten days of April, is esteemed the best time: and accordingly within these periods the greatest quantity of flax-seed is sown in this country.

In the southern countries, however, the husbandmen who raise flax sow part of their seed in September and October; so that the plants which spring from thence remain of course in the ground all the winter; and this may be a judicious practice in those places, because plants which have not covered the earth well before the summer heats come on, are apt to be parched by the heat and drought which usually prevail in that season. They sow linseed again in the spring; but the latter do not yield so large a crop: the flax, however, which it produces is more esteemed, because it is finer than that sown in autumn. M. du Hamel seems indeed to think, that the autumnal sowing yields the best seed; but however that be, in places where the winter is apt to be severe, and where the flax, which is but a tender plant, would in course be in danger of being destroyed during that season, almost all the flax is sown about the end of March, or in the beginning of April.

It may be laid down as a general rule, that the land which is intended for flax should be brought to exceedingly fine tilth by repeated ploughings, and that it should be enriched by a manure suited to the quality of the soil. Thus, when a pasture is broken up in order to its being sowed with flax, it must be well ploughed during several months, before it will be fit for producing a crop of flax. To defray the expense of this culture, some other crops may be got off the land in the mean time, especially of such plants as do not occupy it long, and particularly of those which are remarkably benefited by frequent stirring of the earth whilst they grow; such as beans, peas, turnips, &c. because these repeated stirrings render the mould fine and loose, and help to kill the weeds, which would otherwise do great damage to the flax. It is asserted that the Livonians, when they clear woodlands, burn the wood upon it, then plough it, and in this state prefer it to any other kind of soil for flax. If the land which is intended for flax be stiff, great care should be taken not to till it when it is wet, for fear of kneading it. But if it has been long in tillage, it should be ploughed deep before winter, and laid up in very high ridges, in order that the winter's frosts may the more effectually moulder or loosen it. In the month of February, if the land be not too wet, some very rotten dung should be laid in the furrows, and immediately covered over. In March, for southern countries, or in the beginning of April, where the climate is colder, another ploughing may be given to lay the land smooth; the clods should be broken by hand, or with the spiky-roller, and the seed should then be sown and harrowed in with a light or bush-harrow, so as not to bury it too deep. As this, when young, is a very tender plant, and is more easily injured and checked in its progress by weeds than any other that is usually cultivated in the field, it is indispensably necessary, in order to secure a good crop, either to prepare the land very carefully, by repeated ploughings and harrowings, and by carrying off or burning the weeds, before sowing the seed, or to be at the expense of a troublesome and tedious hand-weeding afterwards, which must be very expensive, and can only be performed where labour is cheap.

The best way of sowing flax, in order to obtain very good seed, is to drill it in equidistant rows, about a foot distant, in which case it may be hand-hoed, which will keep down the weeds, and improve the crop. But it is still better to drill the rows about twenty inches asunder. The seed being smooth and heavy, is very proper for drilling, and in this way a very small quantity of seed sows an acre. The common allowance of seed sown broadcast is, as has been seen, about two bushels and a half to an acre, oftener more than less; but drilled in rows at twenty inches distance, half a peck is sufficient for an acre.

Thick-sown flax runs up in height, and produces fine soft flax; if sown thin, it does not rise so high,

but spreads more, and puts forth many side-branches, which produce abundance of seed, and such seed is much better filled, plump, and heavy, than the seed produced from thick-sown flax. Nothing should be planted or sown between the rows, but the ground should be hoed with a hand-hoe, or small plough, taking care that none of the mould is thrown against the rows; to prevent which, the intervals may be hoed with a triangular harrow, having a proper number of iron tines in it, and guided by two handles fixed behind. By these handles, the tines are made to go deeper or shallower at pleasure; and if the intervals are cultivated with this instrument, beginning before the earth is become stale, and while the weeds are small, the land may be kept very clean, and in fine tilth, at a much less expense than by hand-hoeing: for one horse is sufficient for this work; a great deal may be done in a day, and by a frequent repetition of the hoeings, especially when the earth is dry, the weeds may be so effectually kept down, as never to rise to any height. But the rows must be weeded by hand. Flax thus cultivated is shorter than common, but stronger. It is not so subject as other flax to be beat down and lodged in stormy weather, the stalks of it being fortified by the free admission of the sun and air among them; and there is sufficient room to hand-weed the rows, without lying upon or treading down the flax, as in the common way of weeding.

It is usually reckoned, that in flax sown broad-cast, the flax and seed are nearly of equal value. And it will no doubt be said, that, by sowing it so thin, the crop of flax will be much lessened, which must perhaps in some degree be acknowledged; but the great object here is the quality of the seed, which will be incomparably superior to the seed of crops commonly sowed thick; and if duly cultivated, in the method here laid down, will, in respect of the size and weight of the seed, excel either the Plantation or Riga seed.—In this way, also, lighter land will produce better seed than in the common flax husbandry; because the earth that is kept in fine tilth, to any considerable depth, retains more moisture in dry weather than soils of the same kind that are badly tilled, or suffered to grow stale and hard.

When the goodness of the seed is known, more or less of it is to be sown, according as the husbandman intends either to raise a quantity of linseed for sowing, or to have very fine and soft flax. In this last case, the seed should be sown pretty thick, in order that the plants may rise the closer together, and by that means grow slender and tall, which adds much to the fineness of the fibres of the flax. If the linseed is sown with an intention to let the flax remain for seed, a much less quantity of it should be used, so that the plants may come up thin, and thereby have room to grow to their full vigour and extent. As strong soils should be chosen for this purpose, it may perhaps be most advisable to follow the example of the judicious M. de Chateauvieux, in sowing it in drills, and horse-hoeing the intermediate spaces. He observed in his experiments, that the plants of flax thus raised yielded great plenty of excellent seed.

With some it has been a custom to sow, with their linseed, either annual or perennial grass-seeds, when they intend to lay the land down for pasture after the crop is taken off. But as grass-plants grow but weakly under the flax, it is a practice by no means to be recommended.

Flax is sometimes damaged by insects when it is about three or four inches high. These, it is said, may be destroyed by a slight strewing of soot, ashes, &c. over the crop. At all events, this dressing will give vigour to the flax, though it may not kill the insects.

If any weeds appear among the flax, as is almost always the case, they must be thoroughly rooted out; and that the flax may be as little damaged as possible in the doing of this, the weeders should work as carefully as possible.

The finest flax is most liable to be laid, particularly in countries subject to storms. To guard against this accident, some people run across their flax-field slender poles fixed to stakes: but a better method is to run small ropes across the field, both lengthwise and breadthwise, where necessary; for these, being fastened where they intersect one another, and supported by stakes at due distances, form a kind of net work, which is proof against almost every accident that can happen from tempestuous weather.

Opinions are divided in regard to the degree of ripeness at which it is best to pull flax. Some think it should be pulled whilst it is green, in order that its fibres may be softer and finer. Others, with the same view, pull it up before its seeds are quite formed; and others again think, that it should not be pulled till some of the capsules, which contain the seeds, have begun to open, being of opinion that the fibres of green flax are too tender, and that they fall into tow. On the other hand, it is certain that the fibres of flax which has stood till it is very ripe, are always stiff and harsh, that they are not easily separated from the reed, and that they do not bleach well. Here, therefore, as in most other cases, both extremes should be avoided; and it consequently seems most reasonable to think, that the properest time for pulling flax is when its stalks begin to turn from a green to a yellow, when its leaves begin to fall, and when its seeds begin to be brown.

Mr. Donaldson observes, that a crop of flax frequently grows short, and runs out a great number of seed-bearing branches. When that is the case, the seeds, not the flax, ought to be the farmer's chief object; and the crop should be allowed to stand till the seeds are in a great measure perfected. But that when the crop thrives, and is likely to become more valuable for the flax than the seeds, it should be pulled soon after the bloom drops off, and before the pods turn hard and sharp in the points.

In pulling flax, it is usual, he says, when it is intended to save the seeds, to lay it in handfuls, partly across each other; the reason for which is, that the

business of rippling is thereby facilitated, as the ripplers, in place of having to separate each handful from the bundle, find it by this simple precaution already done to their hand.

It is further observed, that although it is of much importance, yet it very seldom happens, that much attention is bestowed to separate the different sorts of flax from each other, in pulling the crop. In most fields, there are varieties of soils; of course some parts of a field will produce fine flax; others coarse; some long, and some short: in a word, crops of different lengths and qualities. It cannot be supposed that all these sorts of flax will undergo an equal degree of watering, grassing, breaking, and heckling, without sustaining great injury. Therefore, when flax of various qualities is promiscuously mixed together in pulling, it is impossible to prevent some part of it from being lost in the after-management; a loss which might be avoided with a small share of attention, and some additional trouble when the crop is pulled. Those who rent flax-mills are often, he observes, blamed for embezzlement; but there is great reason to believe, very unjustly. Because the crop of a particular part of a field yields such a quantity of flax from one mill, it does not follow that the manager of another mill should return an equal quantity from the same space, probably, of very inferior land. It is certain, in very many cases, that the inattention of flax-farmers to the above very necessary precaution, is the cause why crops of flax often turn out of so little value, and is the principal reason why the proportion of tow or inferior flax so often exceeds in ordinary seasons that of superior quality; the millers and hecklers being obliged, in the course of their operations, owing to the mixed state in which they receive the crop from the grower, to reduce the quality of the whole to a lower standard than there would be any occasion for, were the different qualities sorted, and put into their hands in that state.

As the flax is pulled, it is, as has been observed, laid together by handfuls, with the seed end turned to the south. These handfuls should neither lie quite in a line with each other, nor directly across, but a little slanting upwards, so that the air may easily pass through them. Some, instead of this method, tie the handfuls of flax loosely at the top, then spread out their roots, and thus set several of them together upright upon their roots. In either of these ways, the flax is generally left twelve or fourteen days in the field to dry it. This drying is certainly not necessary for the rippling, because the ripple will separate the capsules from the flax as effectually before it has been dried as it will afterwards; and if it be done with a view to ripen the seed, it should be considered, that the flax will be more hurt by the longer time of steeping, which will become necessary in consequence of this drying, than the seed can be benefited; because the more the membrane which connects the fibres to the reed is dried, the greater must be the degree of putrefaction necessary to loosen and destroy the cohesion of this connecting membrane: the finer parts of the flax itself must necessarily be destroyed by this degree of putrefaction; and if the putrefaction does not arise to such a degree as to destroy the cohesion of this membrane, the fibres of the flax will adhere so strongly to the reed, that the force necessary in scutching will prove equally detrimental to the flax. The practice adopted in some parts of Brittany seems therefore much more rational, which is, to ripple the flax after it has lain in the air two or three days; but even one day will be sufficient, if the weather is dry.

In order to ripple the flax, which is the next operation, a large cloth should be spread on a convenient spot of ground, with the ripple placed in the middle of it. In performing this business, the pods containing the seeds are forced from the stalks by means of the iron-comb called ripple, fixed on a beam of wood, on the ends of which two persons sit, who, by pulling the seed end of the flax repeatedly through this comb, execute the operation in a very complete manner.

After the flax has been rippled, the seeds thereby obtained should be spread in the sun to dry. Those which separate from the pods of their own accord are the fullest and ripest, and should therefore be set apart for sowing, in case the precaution of raising some flax purposely for seed has not been attended to. The pods or capsules are then broken, either by treading or by threshing, in order to get out the remaining seeds, the whole of which, as well as the former, should be carefully sifted, winnowed, and cleaned. When the seed is laid up, it must be frequently stirred, or ventilated, to prevent its heating. Even this second seed affords a considerable profit, by the oil which it yields, and also by being used when broken for fattening of cattle. The cakes of linseed, after the oil has been pressed out of them, are likewise found to be useful for this last purpose, though they are thought by some to render the fat of cattle yellow; for which reason it is advised not to give it them till within a few weeks before the beasts are to be killed. They are likewise of great utility as a manure, but from the expense can seldom be employed in that way. See *Oil-Cake.*

When thus cleared of the seed, the flax is loosely tied in small bundles, and put into pools of soft stagnating water, where it is allowed to remain several days, according to the natural warmth of the water. As soft, clear, stagnating water has been found by long experience to be superior for the purpose to any other, where that cannot be obtained without art, a pit or canal is commonly formed, adjoining to a river or stream, whence water can be easily brought. This pit or canal is filled with water for some time (a week or two) before it be proposed to pull the flax; by this means the water acquires a greater degree of warmth than river-water possesses, and which contributes greatly to facilitate the object farmers have in view in immersing green flax in water, namely, to make the harl or flaxy substance part easily and completely from the boon or reed.

In respect to the period that flax ought to remain in the water, it depends on various circumstances; as the state of ripeness in which it was pulled,

the quality and temperature of the water, &c. The most certain rule by which to judge when flax is sufficiently watered, is, when the boon becomes brittle, and the harl separates easily from it. But although it is the general practice where flax is cultivated in this country, the author of Modern Agriculture observes, to immerse it in water for some time after it is pulled, yet in Dorsetshire, and the neighbourhood, it is seldom done. There the flax is allowed to arrive at that state in which the harl parts most easily from the boon, or reed, by a more gradual process, that of ripening by the action and influence of the dew, which, he says, is nothing more than exposing the flax to the influence of the weather for a longer period than is necessary when the operation of watering has been previously performed. Sometimes, if the steeping be judged sufficient for effecting the separation of the harl, little more is done than putting it up in parcels, or spreading it on the ground to dry.

After steeping the flax, the only other operation which properly falls under the farmer's attention, is *grassing* it. For this purpose it is commonly spread very thin on the ground, and in regular rows; the one being made to overlap the other a few inches, with a view of preventing, as much as possible, its being torn up and scattered by gales of wind. Old grass-ground, where the herbage does not grow to any great height, is the best for the purpose; as, when the grass or weeds spring up so as to cover the flax, it is frequently rotted, or at least greatly injured thereby. Flax is allowed to remain on the ground till, by repeated trials, it is found that the boon has become very brittle; so that, on being broken, and rubbed between the hands, it easily and freely parts from the harl. It is then taken up; a dry day being chosen for the purpose: and, being bound in sheaves, is either sent directly to the mill, which is the usual practice in the northern districts, or broken and scutched, in the manner they do hemp, by a machine or implement for the purpose.

It is remarked by the author of the Present State of Husbandry in Great Britain, that "those who bestow most attention on the cultivation of flax in Scotland generally ripple off the seed, even when there is no intention of saving it; as it is found, when flax is put into water without taking off the pods, the water soon becomes putrid, in consequence of which the flax is greatly injured. But that when it is proposed to save the seeds of flax, the pods are carried home from the field as soon as they are separated from the flax; and either laid on cloths, and exposed to be dried by the influence of the sun, or they are spread on a barn-floor, and turned two or three times a day, till they are so dry that the seeds can be easily thrashed out in the ordinary way. This is the general mode adopted in Scotland. In Dorsetshire, they allow the flax to lie on the field after it has been pulled, till the pods become so dry that the seeds can be thrashed out with a stick; which is done on a board, or log of wood, placed on the field for the purpose."

It is stated, that the quantity of seed produced on the statute acre is generally from six to eight, sometimes as high as ten or twelve, bushels; and that the price depends, in a great measure, on that of foreign seed imported; as, when sold to oil-makers, it is generally about one half of that of Dutch seed sold for the purpose of sowing. The price of home-cultivated linseed is considerably advanced of late in some of the southern and western counties of the kingdom, in proportion to what it is in those of the northern, owing to the circumstance of its being much used as food for fattening cattle. The average price of the linseed cultivated in the kingdom at large cannot, it is supposed, be rated higher than from three to four shillings the bushel.

It is asserted, that there are few crops more variable in quantity, as well as quality, than flax. When sold before pulling, which is commonly the case in Scotland, when cultivated on a large scale, the price runs between 6*l.* and 10*l.* the statute acre; but 7*l.* 10*s.* may probably be rather a high average for it.

It is said to be usual for farmers, in different parts of Scotland, who rent lands in the neighbourhood of towns and villages, to let a field to the inhabitants for the purpose of growing flax. This is supposed to be the most advantageous mode in which this crop can be cultivated. The rent affixed on the land is about 3*l.* 10*s.* or 4*l.* the statute acre, according to the quality; the farmer always undertaking to cultivate the land in a proper manner. The same practice, with a little variation, is also established in some parts of England: the farmer rents or lets the land to a person who is denominated a middle-man, or flax-jobber, and whose business it is to perform all the various operations after the seed is sown; which, as in the former case, is always furnished by the renter, the farmer having nothing more to do than to plough and harrow the ground.

FLAX-*Dressing*, the operations which are necessary for bringing flax into a state of preparation proper for being formed into cloth or other articles. These are various, and require different sorts of implements and machines, in order to their being properly performed. Flax for the purpose of being formed into cambric, fine lawn, thread, and lace, is dressed in a rather different manner than the common. It is not scutched so thoroughly as common flax, which from the scutch proceeds to the heckle, and from that to the spinner: whereas this fine flax, after a rough scutching, is scraped and cleansed with a blunt knife upon the workman's knee covered with his leather apron: from the knife it proceeds to the spinner, who, with a brush made for the purpose, straightens and dresses each parcel just before she begins to spin it.

In the Swedish Transactions for the year 1747, a method is given of preparing flax in such a manner as to resemble *cotton* in whiteness and softness, as well as in coherence. For this purpose, a little sea-water is to be put into an iron pot or an untinned copper-kettle, and a mixture of equal parts of birch-

ashes and quick-lime strewed upon it; a small bundle of flax is to be opened and spread upon the surface, and covered with more of the mixture, and the stratification continued till the vessel is sufficiently filled. The whole is then to be boiled with sea-water for ten hours, fresh-quantities of water being occasionally supplied in proportion to the evaporation, that the matter may never become dry. The boiled flax is to be immediately washed in the sea by a little at a time, in a basket, with a smooth stick at first, while hot: and when grown cold enough to be borne by the hands, it must be well rubbed, washed with soap, laid to bleach, and turned and watered every day. Repetitions of the washing with soap expedite the bleaching; after which the flax is to be beat, and again well washed; when dry, it is to be worked and carded in the same manner as common cotton, and pressed betwixt two boards for forty-eight hours. It is now fully prepared and fit for use. It loses in this process near one-half its weight, which however is abundantly compensated by the improvement made in its quality.

FLAX-*Brake*, a hand-instrument which was originally and for many ages employed in breaking and separating the boon or core from the flax, which is the cuticle or bark of the plant. In performing this business, the flax being held in the left-hand across the three under-teeth or swords of the brake A, *pl.* XLIV. *fig.* 1, and *a*, *fig.* 2; the upper-teeth, B, *fig.* 1, and *b*, *fig.* 2, are with the right-hand quickly and often forced down upon the flax, which is artfully shifted and turned with the left-hand.

FLAX *Foot-Brake*, an implement invented in Scotland, by which flax is broken and scutched with much greater expedition than by the hand-instrument just described, and in a more gentle and safe manner than by the flax-mill. By this contrivance the boon is well broken, by the sloping stroke given as with the scutcher, while the machine is moved by the foot. The treadle is of considerable length, on which account it is put in motion with greater facility, and assisted in it by means of a fly. The scutchers are fixed upon the rim of a fly-wheel. But though these machines may be highly useful where mills turned by water cannot be established, they are probably much inferior in point of expedition and the œconomy of labour. A brake of this kind is represented at *fig.* 3, in which

a, the three under-brake teeth, or swords, seventeen inches long, three inches deep, one and a quarter inch thick at back, and a quarter of an inch at the edge.

b, the edges two and three-quarters of an inch asunder at the end next the guide *b*, and two inches asunder at the other end.

c, the two upper-teeth, about an inch shorter than the under teeth.

d, the rake-mallet, about thirty-three pounds English weight.

e, E, a compound foot treadle.—*e*, is eight feet four inches

f between the fulcra, raised at *f* eight inches above the ground (or rather five inches higher than the stance of the workman), E. is two feet four inches between the

g, fulcra, and is raised at *g* eighteen inches above the ground; that is, fifteen inches higher than the stance of the workman.

h, the sword or upright timber-rod which turns the wheel by the treadle-crank.

i, the treadle-crank, of seven and a half inches radius.

k, the fly-wheel, four and a half feet diameter, above sixty pounds English weight. As here represented, it is of beat or cast-iron, but it may also be made of timber.

l, brass cods or bushes.

m, M, the lifting crank M is fixed firm upon the axle of the fly; while the crank *m*, about eight inches radius, plays freely round the axle. In position first, M begins to take round the crank (which by the lever *r* pulls up the mallet): when it comes to position second, the mallet is again at liberty, and by its weight pulls up the the crank (faster than the fixed pieces move) into position third.

N. B. The treadle-crank is advanced about one-eighth part of the circle before the lifting crank.

A, a small pulley which turns easily round on the end of the crank, and to which a rope is fixed.

o, a piece of timber, which prevents the rope from falling in upon the axle, but which should not rub against the rope in its coming down.

p. Here the rope passes between two friction-rollers, which are so placed, that it comes down three or four inches, or half the radius of the lifting crank, or the side of a plummet-line crossing the centre of the wheel, that is, to the side on which the crank turns when it pulls down the rope.

q, a pillar, which serves only to support the guard for the rope *o*, and the friction-rollers at *p*.

r, the lever.

s, the lever-pillar.

t, part of the mallet-frame.

u, two pillars which guide the brake-mallet.

v, an iron spring, which receives the leap of the mallet, and throws it the quicker down.

w, the pillars which support the fly.

x, *u*, the pillars which bear the brake-teeth and mallet.

y, the spur and cross that support the pillars.

z, the bottom frame-piece.

A,A,A, broad stool upon which the workman stands, three inches above the ground.

The brake-teeth are made of good beech or plane-tree; the brake-mallet of plane-tree, ash, elm, birch, or oak; the sword, or upright timber-rod between the treadle and the treadle-crank, of beech, plane-tree, or birch; and the lever, of beech, ash, or oak. The fly-wheel, if timber, should be made of oak, ash, beech, elm, or plane-tree. All the other parts of timber worth mentioning may be made of fir.

This brake may at any time be converted to a beater of flax and hemp, by removing the brake-teeth, and putting in their place flat-boards. In the upper of these boards may be driven thirty-two nails, the

heads about three-quarters of an inch long, and the points of the heads about a quarter of an inch diameter; the points of the nail-heads may be placed one inch clear asunder, and in the order marked *b*, at equal distances, as in this way any of the nails may most easily be drawn out in repairing the mallet. An iron hoop put about the mallet will prevent its bursting with the driving in of the nails. In the time of beating, the narrow end of the mallet is placed towards the workman; and where there is much work in that way, the mallet and fly may be made heavier, and then two or more workmen can work together upon the foot-treadles, which may also be made equally long.

Fig. 4. represents the beating or scutching-machine, where *b*,*g*,B, is the foot-board; *d*,*d*, scutchers; *q*, the centre of the iron wheel *c*,*c*,*q*; *s*, the upright piece, or scutching stock; *a*, the piece on which the hand rests in order to scutch the flax. The machine is put in motion by the notch at M, which is moved by the foot-board.

Flax-*Heckle*, an instrument constructed for the purpose of heckling or straightening the fibres of the flax, which is seen at *fig.* 5. It has many teeth fixed in a square flat piece of wood. When used, it is firmly fixed to a bench before the workman, who strikes the flax upon the teeth of the heckle, and draws it through the teeth. To persons unacquainted with that kind of work this may seem a very simple operation; but, in fact, it requires as much practice to acquire the method of heckling well, and without wasting the flax, as any other operation in the whole manufacture of linen. They use coarser and wider-teethed heckles, or finer, according to the quality of the flax; generally putting the flax through two heckles, a coarser one first, and next a fine one.

Flax-*Mill*, a mill contrived for the purpose of breaking and scutching flax in a more expeditious manner than by the hand or foot methods. It was invented in Scotland many years ago, but has been lately much improved; and, by being driven by water, makes great dispatch, and in skilful and careful hands gives satisfaction. It has been generally constructed to break the boon by three dented rollers, placed one above the other; the middle one of which, being forced quickly round, takes the other two along with it; and one end of the handfuls of the flax being by the workmen directed in between the upper and middle rollers, the flax is immediately drawn in by the rollers; a curved board or plate of tin behind the rollers directs the flax to return again between the middle and undermost rollers; and thus the operation is repeated until the boon be sufficiently broken. Great weights of timber or stone at the ends of levers also press the upper and under rollers towards the middle one.

The scutching is next carried on by the mill in the following manner: Four arms, something like the hand-scutchers before described, project from a perpendicular axle; a box around the axle incloses these projecting scutchers; and this box is divided among the workmen, each having sufficient room to stand and handle his flax, which, through slits in the upper part and sides of the box, they hold in to the stroke of the scutchers; which, moving round horizontally, strike the flax across or at right angles, and so thrash out or clear it of the boon.

The breaking of the flax by rollers is scarcely subject to any objection, except that it is dangerous to workmen not sufficiently on their guard, who sometimes allow the rollers to take hold of their fingers, and thereby their whole arm is instantly drawn in: thus many have lost their arms. To avoid this danger, a brake, upon the general principles of the hand-brake before described, has been lately adapted to water-machinery, and used in place of rollers. The horizontal stroke of the scutchers was long thought too severe, and wasteful of the flax; but very careful experiments have discovered, that the waste complained of must be charged to the unskilfulness or negligence of the workmen, as in good hands the mill carries away nothing but what, if not so scutched of, must be taken off in the heckling with more loss both of time and flax. But to obviate this objection of the violence of the horizontal scutchers, an imitation of hand-scutching has been applied to water. The scutchers there project from an horizontal axle, and move like the arms of a check-reel, striking the flax neither across nor perpendicularly down, but sloping in upon the parcel exactly as the flax is struck by the hand-scutcher. This sloping stroke is got by raising the scutching-stock some inches higher than the centre of the axle; and by raising or lowering the stock over which the flax is held, or by screwing it nearer to or farther from the scutchers, the workman can temper or humour the stroke almost as he pleases.

A lint-mill with horizontal scutchers upon a perpendicular axle, requires a house of two stories, the rollers or break being placed in the ground story, and the scutchers in the loft above; but a mill with vertical scutchers on an horizontal axle requires but one ground story for all the machinery.

Flax *Rippling-Comb*, an instrument formed by setting six, seven, or more long square teeth, nearly upright, in a long narrow piece of plank, so as that their different angles shall come nearly to touch each other. By drawing the flax through between these teeth, the bolls, in which are the seed, are forced off. It is seen at *fig.* 6. If the flax is to be regarded more than the seed, it should, after pulling, be allowed to lie some hours upon the ground to dry a little, and so gain some firmness, to prevent the skin or harl, which is the flax, from rubbing off in the rippling; an operation which ought by no means to be neglected, as the bolls, if put into the water along with the flax, breed vermin there, and otherwise spoil the water. The bolls also prove very inconvenient in the grassing and breaking. In Lincolnshire and Ireland, they think that rippling hurts the flax; and therefore in place of rippling, they strike the bolls against a stone. The handfuls for rippling should not be great, as that endangers the lint in the rippling comb. After rippling, the flax-raiser will

perceive that he is able to assort each size and quality of the flax by itself more exactly than he could before.

Flax *Stock and Scutcher*, implements for breaking, cleaning, and scutching flax in the old method. In this business, the workman with his left-hand holds the flax over the stock *figs.* 7 and 8, while with his right-hand he strikes or thrashes the flax with the scutcher, *fig.* 9.

Flax-Seed, the seed obtained from flax by means of beating or rippling off the bolls in which are the seeds. It is recommended for stall-fatting by Mr. Marshall, in his Rural Economy of Glocestershire, where he says, that, next to hay, oil-cake made of linseed is the main article of stall-fattening. But the price of this article is at length become so exorbitant, that it no longer, he is afraid, leaves an adequate profit to the consumer. Some years back, he recollects, it was the idea of men of experience, that it could not be used profitably as an article of fattening for cattle at a higher price than three pounds a ton. Now (1788) it is, in some places, more than twice that price. The lowest price, at the more distant mills, is, he is well informed, five pounds; at Berkley mills, six pounds; at Evesham, six guineas; at Stratford, six pounds ten shillings a ton. Since this, the rise has been still more considerable. See *Oil-Cake.*

Flax-Seed *Jelly.* The mucilaginous and jelly-like substance prepared from the seed by gentle boiling.

It is observed by Mr. Marshall, in his Rural Economy of the above county, that the extravagant price of oil-cake has induced some spirited individuals to try the linseed itself in feeding, boiled to a jelly, and mixed with flour, bran, or chaff; and that, from the information he has had, with favourable success. This novel practice, says he, requires a few minutes reflection. From the present scarcity and dearness of cakes, it may be inferred that the demand is greater than the quantity in the markets. If, therefore, the seed can be profitably used, though with only a small increase of profit, and with this even on a contracted scale, the use of it may operate very beneficially, by lessening the demand, and thereby lowering the exorbitant price of the cakes. It is highly probable, however, that it may be used with much greater advantage than cakes at their present price. He has by him a sample of American seed (nearly equal to the best Dutch seed he has seen), which may now (1788) be imported for thirty-eight to forty shillings a quarter, of eight Winchester bushels. Supposing the bushel to weigh 50lb. the price of this prime seed is not, he says, twelve pounds a ton. Ordinary seed might be had cheaper. It is farther probable, he thinks, that the superior kind of nutriment which the cakes afford proceeds from the unexpressed oil they may contain, rather than from the husks of the seed of which they appear to consist. This being admitted, and seeing the excessive power which is used in extracting the oil, we may without risk, he says, conclude that a ton of seed contains more than twice (perhaps five times) the nourishment which remains in a ton of cakes.

He supposes the principal objection to flax or linseed-jelly is, the trouble of preparing it. In an instance in which it was used with success, the method of preparing it was this: The proportion of water to seed was about seven to one. Having been steeped, in part of the water, eight-and-forty hours, previous to the boiling, the remainder was added, cold; and the whole boiled, gently, about two hours; keping it in motion during the operation, to prevent its burning to the boiler; thus reducing the whole to a jelly-like, or rather a gluey or ropy consistence. After being cooled in tubs, it was given in this instance, he says, with a mixture of barley-meal, bran, and cut chaff; each bullock being allowed about two quarts of the jelly a day, or somewhat more than one quart of seed in four days: that is, in this case, about one-sixteenth of the medium allowance of cake. This is, however, he says, thrown out as a general idea; not drawn as an inference: the comparative effect of these two materials of fattening forms, he thinks, an important subject for the decision of experiment. Viewing the present subject in a partial light, it might, he supposes, be said that an unlimited and excessive use of a foreign article of fattening for cattle might lessen the demand, and therby lower the value of our own productions, applicable to the same purpose, to the injury of the landed interest. If, however, we consider, that by the use of foreign lin or flax-seed, an influx of the first vegetable manure we are acquainted with, would be diffused over the soils of this country, and that wheat may be exported at a price more than equivalent to the present price of linseed, the landed interest would seem to have no cause of alarm; while, in a more general point of view, the importation of linseed from America might be a national good. He understands, from intelligence of the first authority, that some of the finest provinces of that country are in a great measure destitute of marketable returns for the produce and manufactures of this kingdom; and further, that linseed, which can there be grown in unlimited quantities, is at present a drug in the American markets. See *Oil-cake* and *Stall-feeding.*

FLAY-CRAKE, a term used to signify a scare-crow.

FLAYL. See *Flail.*

FLEABANE, the name of a perennial weed common in pastures, the stalk of which is round, bending, solid, and heavy. The leaves are oblong, sharp-pointed, wrinkled, downy, and embrace the stalk on which they grow very thick without any regularity. The flowers are yellow, radiated, and inclosed in a flower-cup made of narrow scales like bristles. It is sometimes called *fleawort.*

FLEAK, a wattled hurdle or kind of gate, which, by negligent farmers, is sometimes set up in the gaps of their hedges. See *Hurdle.*

FLEAM, in *farriery*, an instrument used for letting blood in horses or other animals. A case of fleams, as it is called by farriers, comprehends

six sorts of instruments; two hooked ones called *drawers*, and used for cleaning wounds; a pen-knife; a sharp-pointed lancet for making incisions; and two fleams, one sharp, and the other broad-pointed. These last are somewhat like the point of a lancet, fixed in a flat handle, and no longer than is just necessary to open the vein.

FLEAWORT, a plant of the weed kind. See *Fleabane.*

FLECKED, a term used to signify pied, as cattle.

FLEECE, the woolly covering shorn from off the body of the sheep, and rolled up into a long round form. See *Wool* and *Sheep.*

FLEMISH *Husbandry*, that sort, by means of green crops, which was much practised at an early period in the low countries.

FLESH, a term signifying that component part of an animal body which consists of bundles of red fibres, laid side by side, and connected together by cellular membrane. And the exuberant granulations which rise up in an ulcer above the level of the surrounding skin, and which are restrained only by dry applications and pressure, are commonly called *proud* flesh. In respect to the feeding and fattening of animals, the nature and properties of flesh are of much consequence to the breeding and grazing farmer. See *Cattle* and *Fungus.*

FLET-MILK, such milk as has been skimmed, or had the cream taken off from it.

FLEWS, a term provincially applied to the phlemes for bleeding cattle.

FLINTS, small sharp sorts of flinty or vitrifiable stones, which frequently abound considerably in some sorts of soils.

FLINTY *Gravels*, such as contain a large portion of flints in them.

Flinty *Soils*, such as have a large proportion of flinty materials in their compositions. These are seldom of a fertile quality. See *Soil.*

FLOAT, timber bound together to be conveyed by water. It also signifies to turn water upon meadow-land for improving it. And likewise to pare off the surface or sward. See *Raft.*

FLOATING *of Meadows.* The practice of covering them with water for improving them. See *Meadow* and *Watering of Land.*

Floating-*Upwards*, the old method of watering land by daming up the water so as to cover it.

FLOCK, a number of sheep kept together under a shepherd.

Flock, *setting of*, a term applied to the practice of determining the proper sorts of sheep and other kinds of stock by the farmer. It is practised annual with the lamb-stock, where the sheep system is extensively carried on.

FLOTE-FESCUE *Grass*, an excellent grass for cattle, growing in watery places. It is said to afford excellent feed for horses. Mr. Stillingfleet says, that Mr. Dean, a very sensible farmer at Ruscomb in Berkshire, assured him that a field always lying under water, of about four acres, that was occupied by his father when he was a boy, was covered by a kind of grass that maintained five farm-horses in good heart, from April to the end of harvest, without giving them any other kind of food, and that it yielded more than they could eat. He, at his desire, brought him some of the grass, which proved to be the flote-fescue, with a mixture of the marsh-bent. Whether this last contributes much towards furnishing so good a pasture he cannot say. They both throw out roots at the joints of the stalks, and therefore are likely to grow to a great length. It would therefore seem that the flote-fescue is a good grass to cultivate for the use of horses, especially as it appears to thrive best in wet low meadows, where many other grasses would not grow. See *Festuca* and *Grass.*

FLUKE-WORM, a small flat worm sometimes found in the livers of sheep that have died of the rot. See *Rot.*

FLUOR ALBUS, in *farriery*, a white thickish discharge which takes place from the vagina or shape of animals. It is sometimes found to exist in old broken-down mares.

FLUX. See *Dysentery* and *Lax.*

FLY, a disease in turnips, which is supposed to be produced by a fly that eats the leaves. It is observed by the author of the Philosophy of Agriculture and Gardening, that if this destructive insect be of the scarabæus, or beetle kind, which arises out of the earth, it may be destroyed by rolling. He remarks, that the Chinese are said, by Sir G. Staunton, to steep all their seeds in liquid manure until they swell, and the germination begins to appear; which they believe not only hastens the growth of the plants, but also defends them against insects beneath the soil; and that to this, Sir George observes, it may be owing that the Chinese turnips escape the fly, so injurious to them in this country. An observation of Mr. Guillet, in the Bath Agricultural Papers, seems, he says, also to confirm this idea. He asserts, that when turnip-seed is sown during rain, or has rain immediately afterwards, that the first leaves are so vigorous, that the fly never attacks them; or that the rain itself is so inconvenient to the fly, as to prevent its appearance. It is likewise supposed by the Rev. Mr. Stacy, in his Observations on the Failure of Turnip-Crops, that the dryness of the soil at the time the seed is put into the ground, and the great heat of the season, by not suffering the seed to vegetate quickly, is a principal cause of the destruction that so frequently takes place in crops of this kind. It is also asserted by Mr. Exeter, in the Transactions of the London Society of Arts, that the sowing turnips in drills, deeper than by broadcast, accelerates the growth of the plant, by giving it more moisture; whence it sooner puts forth its rough leaves, and escapes the depredations of the fly. He speaks highly, Dr. Darwin observes, of the use of the drill, advises the rows to be one foot distant, uses three-quarters of a pound of seed to an acre, and sows them from one inch and a half to two inches deep. As it is probable that injury may be done by sowing too deep, as well by the contrary in either,

it would be the best practice to always choose as moist a season as possible for sowing the summer crops of this kind of seed. And when the season is very dry, to have recourse to the steeping of the seed for a few hours, but not more, before it is put into the earth. It is likewise probable, that by the sowing of raddish, mustard, or some seed which would produce plants that this insect would prefer, with the turnip seed, the disease might be much guarded against, or wholly prevented.

It has also been found, that by having the ground rich with manure, the attacks of the fly are much lessened, as by that means the young plants are rapidly pushed forward into the state of broad leaf, when they are secure. Mr. Young likewise states, that his son, in a crop of turnips drilled in the Northumberland method, and sooted as near as possible along the rows of the plants, as soon as they could be seen in them, by sprinkling it along them by the hand from a seed-lip in a sort of stream, they escaped the fly, and were the only turnips in that vicinity that did so. It was, he says, a thought of his own, as he had never read the passage in Ellis's Practical Farmer, in which, he says, that turnips sooted about twenty-four hours after they are up, will be certainly secured from the fly. See *Turnip.*

Fly, in *farriery*, a disease in sheep, produced by a species of maggots, which are very troublesome and injurious to that animal. This is a complaint that mostly takes place in such sheep as are weakly, and in the wool of which there is not a proper quantity of what is termed *yoke*, on which account a more convenient *nidus* or nest is afforded for the fly to deposit its ova or eggs in. When thus deposited, the heat of the body of the animal soon hatches them, and they immediately eat into and feed upon its flesh, if not prevented: the best method of removing which, is, after having the wool cut away as much as possible, and the maggots removed, to apply over the part a portion of tar, or a mixture of train-oil and sulphur, or, where the maggots are not completely formed, by dusting the part with the powder of white-lead. If this be not done, the sheep is soon destroyed. In wooded districts, where the inclosures are small, the sheep should be daily looked over to see that they have not been struck with the fly, as, in the course of a few hours, irremediable injury may be produced.

It has been remarked by Mr. Marshall, that "as a preventive of the fly, the midland shepherds use curious applications, especially to the lambs. Train-oil is found to be efficacious; but it fouls the wool, and makes the sheep disagreeable to touch. An ointment made of butter and the flowers of sulphur seems to be in the best repute. The butter being melted, a sufficiency of brimstone is stirred into it, to form an ointment of a pretty firm consistency. In application, a piece the size of a small walnut is rubbed between the hands, and these drawn along the backs of the sheep." He adds, that "insects certainly have their antipathies, and to find out those of the sheep-fly is an interesting subject of enquiry." He says, that "the method of destroying maggots there is effectual, and, if applied in time, simple and easy. Instead of cutting the wool off the part affected, and scraping off the maggots with the points of the shears, the wool is parted, and the maggots picked out with a knife, or otherwise dislodged, without breaking the coat; and a small quantity of white-lead scraped from a lump, among the wool; which being agitated, the powder is carried evenly down to the wound. Too much discolours the wool: a little prevents any further harm from the maggots that may be left among the wool, driving them away from the wound; and, at the same time, is found to promote its healing. In well-shepherded flocks, which are seen regularly twice a day, there is," he says, no such thing as a broken coat." This practice, though very proper, does not, however, always succeed. The calces of mercury are, in some cases, found most effectual.

FOAL, the young of the horse kind. The male is termed a *colt* foal, and the female a *filly* foal. Foals, where they are of a valuable kind, should always be kept as well as possible while they are growing; as without attention in this respect they seldom make good horses.

Some contend, that "it is no difficult matter to know the shape that a foal is likely to be of when full grown; for the same shape that he carries at a month he will carry at six years old, if he be not abused in the after-keeping; and as the good shape, so will be the defects also. As to the height, it is observed, that a large shin-bone, long from the knee to the pastern, indicates a tall horse. Another way of judging is, to see what space he has between his knee and withers; which being doubled, it will be his height when he is a competent horse. There are also means to know their probable goodness; for, if they are stirring, not apt to be frighted, active, and striving for mastery, some assert, they generally prove good mettled horses when fully grown.

Foal-*Teeth*, those of the first year. See *Age of Horses.*

FOALING, a term applied to the act of parturition, or bringing forth young in the mare. It sometimes happens that mares kill their foals through carelessness, or from being entangled in the stable with their halters, or through the difficulty they have in bringing them forth. Therefore, great care should be taken at these times by proper attendance. See *Parturition.*

FODDER, a term employed to signify all such substances as hay, straw, haulm, &c. which are given to cattle with the view of feeding and keeping them. These substances, when blended together, are, in some districts particularly, called fodder. In the giving of fodder to all sorts of animals, care should be taken that waste is not committed by their having too much given at a time: and that it be well put into racks or cribs, which should be sufficiently numerous for the quantity of cattle. Where these points are not properly attended to, there must be great loss, not only by the fodder being littered about the yard, but from many of the more weak cattle not getting the quantity of food that may be

necessary for their support. In respect to racks, those of the staddling and basket kinds are best for foddering, if made strong enough; that is, so as not to be overturned; for these racks may be lifted up as the dung rises in the yard, which those fixed in the ground cannot be.

Open winters make hay the dearest, if a hard frost and snow happen to come at the beginning of them; for if once cattle come to fodder, they must be held to it, or they will receive great damage. In wet or washy weather, all the hay that can be given to cattle will not make them thrive so well as in such as is dry and frosty. Hence sheds are highly useful, in order to shelter them in such cases.

At the beginning of winter, as the latter end of October, and a great part of November, while cattle still continue out in the field at grass, it is very necessary to fodder them early in the morning, while the hoar-frost hangs on the grass, which they will not eat kindly off till the sun has warmed it.

It is a practice in many places to tie cattle up to racks to fodder. This may be done with advantage with the cows, where the fodder is good, as hay, or very good straw; but with young cattle, or such as have straw fodder only, it is unnecessary. And as cattle eat their fodder when fresh thrashed much better than when it has been thrashed two or three days, especially if the straw be but indifferent, it is proper that this should be attended to.

As little dependance can be placed on sending cattle out of the foddering-yard to grass before the middle of May, the farmer ought always to be well provided with winter-fodder for his cows for this and the preceding months.

To have several divisions over and above what is constantly used in the foddering-yards of back-sheds, or other out-houses, has great conveniences in it; one of which is, that in them the farmer can dispose of and separate his two-yearling cows, or other cattle, at the time of bulling; not only to keep them from the bull, but from the other beasts also, that would be leaping such cows, whereby they may hurt each other, &c. especially as cows forward with calf are apt to warp by leaping bulling-cows.

Compressed Fodder, a fodder formed by cutting and mixing together various sorts of coarse substances, such as the haulm of peas, beans, potatoes, and various other vegetables, as well as clover, hay, straw, &c. so as to make them come into a narrow compass. The utility and advantages of this sort of fodder have been shown by Mr. Lawson, in his Essay on mixed and compressed Cattle Fodder.

FODDERING *of Cattle*, the art of giving them their food. In managing this business, great attention is necessary, as has been just seen, in order to prevent the waste of those articles that may be employed, and in seeing that each individual is properly and regularly supplied with a suitable proportion of food.

FOG, a thickness in the atmosphere near the surface of the ground, arising from the floating of gross or heavy vapours in it. See *Mist*.

Fog. See *After-grass*.

FOGGAGE, coarse or rank grass not eaten down in the summer or autumn. The practice of fogging grass-lands for the winter support of stock has been found highly useful. See *Grass-lands*.

FOGGE, a term that properly signifies the grass that immediately springs after the hay-crop has been taken, but which is sometimes used for the long grass remaining in the pastures till winter. See *After-grass*.

FOGGING, a peculiar practice in the management of grass-lands, confined chiefly to the district of South Wales. It consists, according to Mr. Young, "in keeping the whole growth of grass in upland meadows free from either scythe or stock, and eating it in the following winter." He states that, "many years ago, he knew a Suffolk clergyman, who was in the regular habit of this singular practice, and spoke of it as a most profitable one." He has, he says, "tried it thrice, and with success." And he finds, that "it thickens herbage greatly, and yields far more valuable winter and spring food, than any person would expect, who never tried it. But it should, he supposes, be practised only on dry or tolerably dry land." There are, however, no statements of the particular advantages of this system of grass-management.

FOISSEN, a term sometimes used to signify the natural juice or moisture of grass or other herbs.

FOIST, a term signifying musty.

FOLD, a yard or inclosure in which cattle or animals of any other kind are kept and confined.

Fold-*Garth*, a term formerly used to signify a farm-yard.

Fold-*Yard*, the yard where cattle of different sorts are confined and fed during the winter-season. Yards of this nature should be properly fitted up with convenient sheds and racks for the animals to eat their fodder from, and have suitable divisions for containing different denominations of cattle, or other live-stock. See *Farm-Yard*.

Sheep-Fold, the inclosure wherein sheep are confined during the night. These are of two kinds, either houses or sheds erected for the purpose adjoining to the farm-yard, or moveable folds, formed by means of hurdles in the fields. In the former, which is still the common practice in France, Flanders, &c., the floors of the sheds or houses are occasionally covered with straw, sand, or other light dry earth, by which a large quantity of valuable manure is obtained; which, when applied to cold wet soils, is highly advantageous in producing abundant crops. It is observed, however, by the author of Modern Agriculture, that, since a spirit for inclosing, planting, and improvements in general, has been introduced, the original breeds of sheep have been banished to the mountainous districts in the northern parts of the island, where cultivation has hitherto been deemed impracticable. Within these few years, indeed, some valuable breeds of sheep have been brought from the southern parts of the kingdom; but they are generally kept in gentlemen's parks, and are never penned or housed. So that, he thinks, the quantity of sheep-dung applied to tillage-lands in the ancient manner is very trifling, compared to

what it was formerly; that practice existing in those parts of the country only which separate the lands that are generally or closely cultivated, from the mountainous districts, where sheep-husbandry, on a large scale, and under a regular system, is established. In speaking of sheep, a moveable house for this purpose will be taken notice of, which has been found very useful in Hertfordshire. See *Sheep-House.*

In Hertfordshire, according to the Report on Agriculture for that district, they find great advantage from the raising of manure in folds of this kind. The Earl of Clarendon, at the Grove, has a yard that "contains good room for three hundred—the number kept in it: an open shed surrounds it, except on one side, where a barn is the fence; the outside of the shed is formed of wattled hurdle-work, without straw or other materials, for coolness, lest a greater closeness should make the yard too hot: it is all kept well littered with stubble, and yields, from three hundred sheep, eighty large cart-loads of manure. The system agrees perfectly well with the sheep, and keeps them more healthy than when they were left in the fields in the common manner." And "his lordship has another yard for lambing, which has also a shed."

In the Norfolk Report, it is likewise stated by Mr. Young, that in 1792, he found Mr. Bevan have "a yard well fenced in for a standing fold, in sight of the shepherd's windows, for littering and folding in bad weather:" And, he says, that in "1802, he continues the practice, and is well persuaded of the great advantage: he thinks it is indispensable, and means in future to have his flock in for yeaning, whether the season be good or bad; and has always, fifteen or twenty loads of hay stacked in it for them to help themselves: he finds this not attended with any waste."

In other counties, much advantage has likewise been found from the practice of folding sheep in covered folds for the purpose.

It is stated, by the author of the Farmer's Calendar, that where this method of folding is well followed up, during the months of December, January, February, March and April, with an adequate proportion of litter, with a hundred sheep, a dunghill of at least sixty loads of excellent stuff, capable of manuring two acres of land in a perfect manner, will be produced; while the same number of sheep folded in the field, allowing the grass-land to be dry enough, will not in the same time manure one acre in an equal degree.

The latter method, which is now the most common, is to pen or fold the sheep themselves upon the land, which on dry friable soils in particular is found to produce beneficial effects. They are sometimes, however, folded on old pastures, but more frequently on lands in tillage; especially on fallows, as a preparation for a succeeding crop of wheat, and on light soils, by way of top-dressing after the grain is sown, or on fields of turnips. This last method is most generally adopted in the inclosed and best improved districts of the kingdom. The hurdles or rails, which form the fold, are commonly about four feet six inches long, and three feet six inches high, made for the most part of either hazle or willow. About fourteen or fifteen dozen of hurdles are sufficient to inclose a statute acre. They are tied to stakes, fixed in the ground at regular distances, with small branches of trees, twisted when green for the purpose. An acre is considered as a space sufficient for folding from twelve to thirteen hundred sheep. The sheep should never be allowed to lie above one night on the same spot of ground; and of course twelve or thirteen hundred will manure an acre of land daily. By thus connecting sheep-husbandry with the improvement of arable land, much may in many cases be effected, especially upon the more dry and light sorts of soil, where it is capable of being carried to the greatest extent.

Folding *Sheep*, the practice of confining them upon arable or other lands, by hurdles or other means, so as to ameliorate and improve them. This is a method that is resorted to by all open-field farmers as a preparation for wheat, and their chief dependence is upon this species of top-dressing, where the quantity of farm-yard dung is insufficient for their purpose. This mode of mauring is peculiarly adapted to farms where there is a considerable extent of hill or common pasture, or grass-lands that never come under the plough. In such farms, by bringing the sheep in the evening to the fold, a considerable quantity of manure will be made that would otherwise be lost. If the pasture upon which the sheep feed through the day be good, they may be folded without much detriment to the animal for a great part of the year; but where the pasture is scanty this cannot well be done, for the sheep will not be able to pick up a sufficiency of food through the day to enable them to bear the fatigue of travelling to and from the fold, and fasting all night: and unless the sheep have turnips or hay during the winter, their dung will be of small value. It is a bad practice to crowd more sheep into a fold than can lie down at their ease, and it is equally bad to confine young and old, strong and weak, in the same fold. It is far better to afford them room enough, and, in particular cases, to let them remain on the same spot two or three nights till it is sufficiently manured. Feeding sheep in a fold can only be practised upon light dry soils. Here it is still more necessary neither to crowd the stock, nor to put in the weak with the strong: for they will tread down and waste the food, and in the contention for it the strong will deprive the weak of their proper share. On such light dry soils sheep will do good by giving it cohesion with much treading: but on clays or strong loams this does much injury to the lands; turnips, or other green crops, cannot therefore be fed off in such soils, except in dry seasons, but must be pulled and eaten upon a dry stubble or pasture. Upon farms entirely arable, where artificial grasses make a part of the rotation, to bring the flock from the pasture, to fold it upon a fallow, is supposed by some to be only enriching one part of the farm at the expense of another: or, as Mr. Bake-

well always called folding, *robbing Peter to pay Paul.* It is well known that heaths and sheep-walks that have been fed time out of mind, but the sheep constantly folded on other lands, continue as miserably poor as they ever were at any former period. But, besides this, lambs and ewes are damaged by folding, to the amount probably of at least 1*s.* a head. Now the benefit arising from their dung is estimated at about 1*s.* 6*d.* a head; which leaves only 6*d.* each for the advantage of this practice. But there is still another deduction to be made on the number kept, and losses on stock. Divide one thousand sheep into ten flocks of one hundred each, by means of inclosures, and twelve hundred would be kept easier than a thousand were before; and as to many of the distempers and accidents to which flocks are liable, some of which are contagious, they result very much from this practice of folding.

It has been observed, that "if folding be supposed necessary on account of the manure, where farm-yard dung is not made in a sufficient quantity, and other manure is not readily to be obtained, a greater stock of muck might be raised, by littering a dry part of the yard, or a warm corner of some pasture, with leaves, straw, fern, or whatever litter could be had in the greatest plenty, penning them and feeding them there in hard weather, and letting them run into the adjoining pasture only during the day in fine weather. A great quantity of manure might thus be raised in winter from a flock; and, provided they had ample room in the pen, and were to be well supplied with dry litter, the sheep might sustain less injury in thus lying warm and dry, than from being folded on naked land, often wet, and in an open exposure." However, where other good effects are to be produced on land, besides the dung and urine of the sheep, such as their treading, and a certain warmth communicated to the soil by their breath, their perspiration, and the natural heat of their bodies, folding may be the most advisable means for obtaining them.

In regard to this practice, it is observed, by Mr. Young, that "a very great change has taken place on inclosed farms in the practice of the best farmers, especially in Norfolk. They are now fully convinced, he says, that it is an unprofitable practice, except where the openness of downs and common fields renders it necessary for the purpose of confinement. The number of sheep that may be kept on a farm without folding, is much greater, he thinks, than can be supported with it. This is a very essential point. There is a deduction from the farmer's profit, in the injury done by folding to both ewe and lamb, which has been estimated, he says, by experienced judges, at from 2*s.* 6*d.* to 4*s.* per ewe; so that a farmer should consider well, before he determines to follow a practice, which, from a multitude of observations, is pronounced unprofitable. Mr. Bakewell used to call it robbing Peter to pay Paul. The arguments now used in its defence are not, he thinks, satisfactory: it is contended, that if sheep be not folded, they will draw under hedges, &c. for shelter in bad weather; if so, they ought to be allowed to do it, for more would be lost in such cases by forcing the sheep from shelter, than the value of their fold. Where this practice takes place, good shepherds will, in case of rain, get up in the night and let their flocks out of fold, knowing the consequence of confinement on arable land in wet weather. The instinct of these animals will conduct them, he says, much better than our reason, not only where to fly for shelter, but also for choosing their own time to go to rest, and to feed in the morning. These they vary according to seasons and weather; but folding prevents it, and forces them to a regularity never called for by the weather," or probably the œconomy of the animals.

It is further remarked, that "when he began first to entertain doubts of the propriety of folding sheep on any farms in which they can be kept to certain fields in the night without that practice, he desired earnestly to try some experiments that might throw more light on the question than it was possible for reason to do; but to effect this comparatively, was very difficult, as the trial he wished for was such, as should carry some positive conviction with it. He has not been able to effect it fully; but the trials he has made may not be found destitute of power to throw some light on this interesting question." He is "perfectly persuaded, that it would have been impossible for him to have kept, on the same land, nearly such a stock in one parcel with folding. He does not conceive that the fields would have carried three-fourths so managed. Four drivings in a day make them trample much food, disquiet the sheep, and transfer the choice of their hours of feeding and rest from themselves to the shepherd and his boy. While lambs are young, they are injured by this, and the ewes are liable to be hurried and heated; all which are objects that should weigh in the question. When sheep are kept in numerous parcels, it is not only driving to and from fold that affects them; but, he says, they are, in fact, driving about in a sort of march all day long, when the strongest have too great an advantage, and the flock divides into the head and the tail of it, by which means one part of them must trample the food to be eaten by another. All this points the very reverse of their remaining perfectly quiet in small parcels," as should perhaps always be the case as much as possible.

It is however conceived, that "the question turns on the benefit to be reaped by the fold; for if that be great enough to compensate for the loss by such circumstances, the practice may not be condemned." He conceives, that "the reason why farmers are such warm advocates for folding, arises from the power it gives them of sacrificing the grass-lands of a farm to the arable part of it. Their object is corn, by which they can carry off a farm whatever improvement they bring to it. Grass improved is profit to the landlord in future; and tenants are too apt to think, that this is done at their expense. They do not at all regard impoverishing a grass-field in order to improve a ploughed one; and he need not observe, that every sort of sheep-walk is thus

impoverished; so that ancient walks, which have been sheep-pastured perhaps for five centuries, are no better at present than they ever were before; whereas most fields sheep-fed, without folding from them, are in a constant state of amelioration:" this, he says, leads him to remark the effect he observed on several of his own fields. He carefully attended, he says, " through the course of a summer, many gentlemen over his fields, with a view to examine whether the sheep had seemed to have rested only on spots, to the too great manuring of such; or, on the contrary, to have distributed themselves more equally; and it was a pleasure to find, that they seemed generally to have spread in every part, if not quite equally, at least nearly so. The improved countenance of several old lays fed in the same manner, when examined in autumn, convinced him, as well as his bailiff, that the ground had been unquestionably improved considerably. Those fields had carried a very bad appearance for some years, but they were, after sheep-feeding, of a rich verdure, and as full of worm-casts as if they had been dunged. He rolled them heavily in November, but they soon became rough again by worms, and demanded much rolling in spring. They had afterwards a greener and more fertile appearance by far than ever they were before" the experiment was made.

It is further stated on this interesting point of rural management, that " the whole of this circumstance, the value of which he shall be able to appreciate in the trials of future years, belongs to this method of dividing flocks, to the exclusion of folding. The fold is valuable, but so is the improvement of the grass-land, and may, for what he knows, nearly equal it: when, in addition, we include the greater number of sheep that can be kept, and the favour done to them by letting them alone, there remains, in his mind, no further doubt of the fact" being well established.

The able writer remarks, that " it is common to hear flock-farmers in open countries say, they have not the power to manage so. This may be very true, he supposes, upon the major part of the farms, but such have often many inclosures, in which this management might be applied without difficulty," or much trouble in its execution.

But, says he, supposing folding to be the system pursued, it may be remarked " that the farmers in those parts of the kingdom which understand it best, do not extend it so far as they might: they give over folding in November or December, whereas it may certainly be carried on through the whole winter with profit; even supposing that the practice is necessary: on those farms which have a perfectly dry gravely pasture or two, it is advisable to fold all winter on such dry grass-land. It must not be attempted on moist arable land, nor on moist grass land; but on dry pastures. The safety to the sheep is greater, and the benefit to the grass an object." And there is, he says, " another method of gaining all the benefit of folding, quite through the winter, and on all soils; this is, to confine them at night in a sheep-yard, well and regularly littered with straw, stubble, or fern: by which means you keep your flock warm and healthy in bad seasons; and at the same time raise a surprising quantity of dung: so great a quantity, if you have plenty of litter, that the profit will be better than folding on the land. A great improvement in this method, would be giving the sheep all their food (except their pasture) in such yard; viz. hay and turnips; for which purpose they may be brought up not only at night, but also at noon, to be baited; but if their pasture be at a distance, they should then, instead of baiting at noon, come to the yard earlier in the evening, and go out later in the morning. This is a practice which cannot be too much recommended; for so warm a lodging is a great matter to young lambs, and will tend much to forward their growth; the sheep will also be kept in good health; and, what is a point of consequence to all farms, the quantity of dung raised will be very great," as may be seen in the preceding article.

It is remarked, however, by the author of the Synopsis of Husbandry, that " the horned or west-country sheep are to be preferred by the farmer, whose chief intention in maintaining a flock is to improve and fertilise his arable land; and in this respect the sheep forms a very material part of the husbandman's riches: for to so high a degree may land be improved by a proper management of these animals, that with respect to light soils especially, it is, he says, scarcely an hyperbole to affirm, that wherever a sheep hath set his foot, some benefit hath accrued to the owner. The virtues of the fold are well known; besides which, the keeping of corn close trodden in the spring, and thereby counteracting the ill effects of the worm, is a matter of such material import to the renter of thin soils, as to be a sufficient inducement to this practice. These facts are so universally known and acknowledged, that in Hertfordshire, where every farmer is in a greater or less degree a maintainer of sheep, it is, he asserts, an established maxim to date the good or ill success of a tenant from the extent of his fold. Whilst the flock is kept up to its original number, and the sale of the fat sheep replaced by an equal tale of lean stock, the owner is supposed to be in thriving and prosperous circumstances. On the contrary, when the flock is sold off without being renovated by a fresh supply, the fate of such a renter is anticipated by his neighbours, and too often verifies the truth of their prediction, by a rapid declension towards bankruptcy and ruin. Such being the state of the case, it may be no unprofitable inquiry, he thinks, to trace out the several different modes of conducting this business.

" There are several different ways of conducting this œconomical plan on an arable farm: first, by the maintenance of a folding flock; and this is either of ewes or wethers. In the former instance, the lambs are bred on the farm, and weaned for the purpose of keeping up the flock, as the old ewes become fit for the butcher. In the latter, a proportionable number of store wethers must be yearly purchased, to make up the deficiency of those which are fattened, or sold to the feeding grazier for that

purpose. But if the farm is not sufficiently extensive to admit of the practice of folding, or the local situation be such as to decide in preference of a feeding flock, the turnips and sown grasses may be appropriated towards the purpose of fattening wethers, or the raising lambs for the butcher, either in pens or in the field; the one distinguished by the term of house, and the other by that of grass-lambs. Whichever of these methods is pursued, it is obvious that a proportionable quantity of ground must be yearly allotted for turnips, tares, rye, clover, &c. without which it would be a vain attempt to set about the maintaining a flock of sheep: but since it is generally in the option of the farmer, with proper management, to raise a quantity of food equal to the support of his sheep, we will suppose that these matters have been properly attended to, and now proceed to enlarge on each of the methods above enumerated: and first, of an ewe-flock kept for the purpose of folding. In order to conduct this plan of husbandry to advantage, a large tract of ground seems to be required. In farms where a due proportion of pasture is united with the arable land, and these pastures lie contiguous to the uplands, to wean lambs for the purpose of folding is a very judicious method. But where there is neither meadow nor pasture-ground attached to the farm, the business of an ewe-fold cannot be so conveniently practised. On many farms in the neighbourhood of Gravesend, in Kent, this plan is, he says, very advantageously pursued, from the circumstance of each of these farms having a quantity of marsh land annexed to it, at the rate of fifty acres of marsh to one hundred and fifty of the arable. The method which these farmers pursue, is to buy in a number of ewes equal to the size of their farms. If this purchase is made at the Michaelmas fairs, the ewes are then pregnant: if they are bought at the spring markets, they probably have lambs by their sides, which may go to fold with their dams, and the ewes be turned to the ram in the autumn. In order to obtain lambs at a proper season, let the rams be turned among the flock in October, at the rate of one ram to fifty ewes. Here they are to remain for a month, by which time the greatest part of the flock will be impregnated; and to ascertain this fact, it is a custom with many people to besmear the fore bows of the ram with tar and ochre, which easily leads to a discovery. The breeding ewes may continue to go to fold every night, till towards the third month of gestation. But it is to be observed, that in folding either ewes or wethers, but more especially the former, a field of turnips should be provided near the close where they are to lodge in the winter nights, that the flock may not have too long a drift; for these animals are but sorry travellers at best, and in the winter-time, when the roads are become deep and miry, and the ewes begin to be heavy in lamb, a long drift would be highly prejudicial to them. Where such a turnip-field does not lie handy to the fallow, it will be improper to prosecute this business with an ewe-flock, after the wheats have been folded in November. When the folding is discontinued, the ewes should be driven into a pasture, where they may lie quiet and undisturbed, and be often visited by the owner, to watch with a careful eye any accident which may befal them; for sheep, at all times an helpless race, are liable to a variety of misfortunes in the time of gestation, peculiar to that condition. Towards the latter end of February, the ewes will be come near their time for lambing, and should then be removed from the marshes or low pastures, and driven into the turnip-field, or turned on a piece of dry upland pasture. If the farm hath produced a quantity of turnips sufficient to fatten the wethers, a portion of which will be yearly turned out of the fold in this mode of conducting business, the ewes for four or five weeks previous to the time of lambing may be lodged on that part which the fatting sheep have gone over, where they will find an ample sustenance from the shells which were left by their predecessors; as these females, whilst they are going with young, do not require so full an allowance of meat as will be necessary for them after they shall have yeaned, and too great a plenty would be very detrimental to them. But this is to be observed, that proper care should be taken to prevent the wethers from breaking into the part destined for the ewes, which at this period require the most diligent attendance from the shepherd, not only to watch the disorders and accidents which may befall them, but to maintain the fences in good repair, and to see that the hurdles are fixed tight in the ground, and to prevent the inroads of swine or dogs, both of which would be apt to seize the lambs as they fall.

"The lambing season generally commences about the first week in March, when the shepherd will find ample scope to exert his skill and diligence. As the weather at this season of the year is generally unsettled, and the cold often more severe than in any former part of the winter, the lambs, as well as ewes, frequently perish through the inclemency of the season. As the ewes have lambed down, it will be proper to remove them, with their lambs, into a piece of turnips, fenced off for the purpose, where they may neither be annoyed by the lambing ewes, the fatting wethers, or the store sheep, if there are any in the same field, and which, as has before been observed, should be kept separate from the ewes. In this feed, with the daily allowance of a small portion of turnips, the ewes will continue to yield abundance of milk, and, in consequence thereof, the lambs will grow fast, especially if the weather shall prove warm and sunny. When the lambs become to be ten days or a fortnight old, the hurdles should be placed in such manner as to leave a vacancy at bottom in different parts of the drift, where the lambs may creep through, and take their range among the standing turnips. By this management they will enjoy a free air, and a licence to nibble on the turnip-tops, both which circumstances will greatly contribute towards their future growth. When the sheep and lambs shew by their bleating and uneasiness that they require a change of food, which they will pine after when the turnips have advanced far in growth, and the stalks

are become sapless, and the bottoms void of nourishment, they should no longer be confined on the turnip-field. In forward springs, the turnips will be found to be of little use for couples (sheep and lambs) after the middle of April, at which time the lambs will be five or six weeks old; let them, therefore, be removed out of the turnip-field, and driven on the rye, a few acres of which should, in every autumn, be sown on farms where there is maintained a large flock of sheep. Indeed, the rye often affords a good bite early in the month of February, in which case the blade should be eaten down, and a second crop will have sprung up at the time he is now speaking of; let this rye be parted into divisions of two or three acres each, observing the same caution with respect to the openings at the foot of the hurdles, as was mentioned in the feeding of the turnips. In very backward springs it frequently happens, that the turnips are all eaten off, as well as the first bite of rye, before the grass has made an effort to shoot, and the farmer is under the necessity of turning his couples into the marshes by the latter end of March. In order to be provided with a remedy against this untoward event, it is a prudent measure to lay in a piece of grass at the autumn, wherein there is a large quantity of old tore, and not to suffer it to be stocked during the winter: by this regulation, the young grass will shoot much earlier in the spring among this old rowett, than in those marshes that have been taken off more closely by the scythe, or depasturing, and will, in all probability, afford an early bite for the ewes and lambs, when the winter-feed on the uplands shall be exhausted; and as a shift of wind and change of weather may shortly be expected, this will cause the rye to send forth a fresh shoot, and furnish a variety in the pasture, which, with occasional shiftings into the marshes, and perhaps on a piece of forward wheat, will generally lengthen out a supply of food for the couples, and maintain them in tolerably good heart, even in those springs which are the most backward, till the winter tares become fit for their reception. In a kindly time, the grass in the marshes will have attained to a decent length, so as to afford a good bite for a sheep by the first week in April, to which time the turnips and rye will have been competent to the maintenance of the ewes and lambs. Towards the latter end of April, or beginning of May, or perhaps the middle of that month, as the season has been more or less favourable, the winter tares will have got to a sufficient height for feeding. Those who have been accustomed to this mode of husbandry will easily conceive the necessity of suffering the tares to grow to the period when they shall be nearly fit for the scythe, before they be fed off; namely, that at this time they yield the greatest and most lasting quantity of pasture. To this end the field should be parted with hurdles, according to its size, and the number of sheep to be grazed thereon; and let the ewes and lambs be brought out of the marsh when their bellies are full, and driven into the tares, observing that this be not done at a time when there is any moisture hanging on the haulm, either from dew or rain; for, as the pasture arising from these pulse is exceedingly succulent, the sheep would run great hazard in feeding on it when replete with moisture, as he has more than once experienced to his cost; this animal, like all others of the ruminating tribe, being very subject to a disorder from repletion, termed *hoving:* and on this account likewise the folding flock, when first driven on the tares, ought to go thither with full bellies, to prevent their feeding on them with too great eagerness and avidity. At this time the lambs will have gained sufficient strength to admit of their being folded with their dams, if it should be found necessary to the farmer's occasions to pursue this method. But in this case it is to be supposed, that the field which is to have this dressing be at no great distance removed from the close of tares, otherwise the drift would prove highly prejudicial both to the ewes and lambs. The summer fold is generally pitched on a fallow intended to be sown with turnips in the course of that season, and this business usually commences in May. A fold for three hundred ewes and lambs may be made to inclose eight rods of ground; and if the trundles shall not seem to be dropped sufficiently thick from one night's dressing, the sheep may lie a second night in the same place, rather than incur the hazard of injuring the health of the couples, by confining them in too narrow a compass. The time when the sheep and lambs should go to fold, is about eight o'clock in the evening, and to be released at five in the morning. Such wether lambs as are intended to be fattened, or double couples where the ewes do not give a quantity of milk equal to the demand of the lambs, or any others which may be observed to sink in flesh, may with their dams be taken out of the fold, and maintained in a separate pasture, where the grass has attained a sufficient head; and such of the folding ewes as appear to be weakly or distempered, may from time to time be removed to the same pastures above mentioned, and suffered to lie in quiet till they are judged able to return again to the fold."

It is added, that, "as it is likely that there will be some dry sheep on the farm, consisting of the two-yearling wethers and tags, these are to be kept on more ordinary pasture than the ewes and lambs; and as they have hitherto followed them in the turnips, so they must likewise succeed them on the clover and tares. The couples are to be allowed the first bite, and the store sheep are then to be turned into the field. In the marshes, likewise, the same method should be taken of reserving the most forward growths for this part of the folding flock: by such management, there will be two folds at work in the same instant, and the shepherd will find ample employment throughout the day.

"After the tares are eaten off, the clovers and trefoil will be ready to receive the flock, and here the sheep and lambs are to precede the dry stock; and the fields, if extensive, should be parted with hurdles, that the sheep may not staunch the whole piece before they have eaten half the field, which would inevitably be the consequence, if they were permitted to range over a large close; for it is the nature of this animal, when turned at first into a field, to take a

range over the whole superficies before it will settle on its feed. It follows, therefore, that a division of large pastures will lengthen out their abode in them; small inclosures do not require it, which, by the bye, shows the advantage of these contracted pieces over those of wider extent; for in these small fields the sheep lie much warmer in the winter, and a considerable expense is saved in hurdles, which in large fields are required in great abundance, besides the labour of setting them, and the necessary delay of time where the horses must be taken off from other work to draw them to and fro. For these reasons, small fields, to a farmer who places much dependence on his flock, are far more commodious than large ones; but for corn, the preference is to be given to those of wider domain. A good shepherd will be careful that his flock be driven late to fold of an evening, and released early in the morning from their confinement, in order that they may enjoy the coolest parts of the day on the food. He will be cautious that they are allowed a sufficient time to graze in the uplands previous to their being driven into the fold, that they may retire to rest with full bellies, by which the quantity of dung and urine will be considerably augmented. He will likewise be careful in reviewing the hurdles, and provide that these are fixed tight in the ground, lest by any accident they should be thrown down during the night, and the flock by these means get into mischief, or intermix with other sheep; he will count his sheep regularly every evening when he drives them to fold, and take a fresh tale in the morning when he turns them on their feed; he will, previous to dismissing them from the fold, worry them gently round the same, in order to cause them to dung and stale plentifully, that the manure may be left in the field, otherwise the greatest part of the trundles will be dropt on the road, or carried on to the marsh, where, lying thin, this dressing can do but little service, and where it is not wanted.

"After the sheep have been shorn, as they are very tender for some little time, it will be advisable to keep the flock out of the fold for a week, and, during that time, not to turn them on any pasture where there are thistles or other annoyances. If the weather should prove hot and dry at this season of the year, the natural grasses and clovers are generally short, and the farmer is at a loss for a baiting-place whereon to turn his flock, previous to their going into the fold, unless he hath had the foresight to raise a piece of spring tares for this use. At this time, likewise, the fallow ground works like ashes; and, by the heat of the sun, great part of the invigorating juices arising from the dung and urine of the sheep is evaporated, so that it may well be questioned, whether it be productive of any material advantage to fold the sheep at this season? That the sheep are greatly injured from being folded under these circumstances, especially if their drift is of any distance, with the intervention of a dusty turnpike-road, for a quarter of a mile or more between the marsh and the fold, as is frequently the case, he is fully convinced: it would therefore perhaps be prudent to discontinue the folding till the rains about Midsummer, when a day's work may be ploughed, on a lay intended to be sown with wheat in November, and the fold immediately set on that part, and so to proceed on the ploughed ground; and thus the folded surface, although the sun should still continue hot, and quickly exhale the moisture of the dung and urine, will nevertheless enjoy an exclusive benefit of being closely pressed by the tread of the sheep, which will prove of infinite service, and which could have been of no use on the turnip-fallows, where the fold had hitherto been set. After weaning the lambs, by continuing the fold at work on the lays in the manner before noted till November, a flock of two or three hundred sheep will have dressed a considerable breadth of new lay ground, and the wheat may then be harrowed in. But now commences a method of folding which is of more importance than any which has preceded it. This is to fold on the wheat when sown, the method of doing which is as follows; first, sow a day's work on a lay that has been ploughed ever since the Midsummer rains, and the seed being harrowed in, pitch the fold, and let the sheep lie on the new-sown furrows; and so continue every night till the whole is completed, unless there should fall so heavy a glut of rain as to make it unadvisable to lodge the sheep on the damp ground; otherwise there will be no fear of treading the surface too close after sowing; for, on light soils, a firm texture is absolutely necessary towards the future welfare of a wheaten crop, especially when this grain is sown on lays, which, if not well trodden, is subject to be much eaten by the worm; but there need be no doubt of the corn forcing its blade through the hardened surface, although, from its appearance, a person unacquainted with this business would deem it impracticable. When the fold shall have gone over this first drift, let another day's work be ploughed, sown, and harrowed in, and the fold continue to run over the same in like manner as before directed, and so proceed till the wheat-season is finished, and the corn begins to germinate, when it will be proper to discontinue this practice as quickly as possible."

At this period the flock may commence their winter folding, the manner of which is thus explained. "And first, he supposes that the farmer has taken care to provide a due allowance of meat for his sheep on the uplands, as likewise a sufficient stock of hay or pea-straw for them to browse on, whilst in the fold (during the long brumal nights); for at this season they will require some sustenance in the night, which at the summer folding was not necessary to be given to them. Let the fold be then pitched on a stubble, intended to be ploughed up in the spring for a fallow, and let it be made considerably larger than the summer folds. A flock of three hundred sheep ought not to be limited to a less space of ground than forty rods, which is a quarter of an acre, in which there should be placed a sufficient number of racks, filled with hay or pea-straw; and in this fold they may lie two or three nights at the option of the owner. Whilst the weather continues mild and open, and is not attended with too considerable a proportion of moisture, the sheep may run in the marshes during

the day-time, and be baited in the uplands, on a piece of young clover or other succulent food, towards the evening, previous to their going into the fold; but when the weather becomes cold and wet, with sharp winds, they must no longer be driven into the marsh, but be maintained altogether on turnips, near to the field where the folding is carried on; and if it does not suit the farmer to apportion any of this winter food for his folding stock, the business must be altogether relinquished, since it would be highly improper that the sheep should have so long a drift in the depth of winter. Whilst the business of the fold is going forward on the stubble in the night, as before mentioned, the sheep may be employed during the day in treading the wheat; a practice of great utility both in the autumn and spring, and which in some degree answers the end of the fold, to that part of the land which had not before partaken of this advantage. In this winter folding, the lambs ought not to share in any degree, though they are sometimes penned in the fold with the sheep after weaning-time. Towards Christmas, it will be proper to discontinue the ewe-fold entirely, as the ewes do then get heavy in lamb, and might be greatly injured through a longer continuance of this practice. At this time, therefore, the breeding ewes should be turned into the marshes, to lie quietly during the time of gestation; and if the folding be any longer continued, let it be with the young wethers and ewe tags."

It is remarked, that the winter folding being finished, suppose the feeding wethers to be on turnips, and the lambs and young sheep on the grattens, with occasional shiftings on the shells of the turnips, left by the fattening sheep, and the breeding ewes quietly lodged in the marshes or low pastures.

We now come to the method of conducting a folding flock of wethers, which is generally adopted by those farmers only who possess not the advantage of breeding land, as from what has been mentioned on that head, and what remains to be said on this, it will appear on a comparison, that the balance is much in favour of the breeder, where the situation of the farm will allow of the practice. "But in order to maintain a folding flock where there is no marsh land or natural grass attached to the farm, it will be necessary that the arable land be sufficiently extensive to admit of raising annually a quantity of turnips, rye, tares, clover, and trefoil, in proportion to the exigencies of the flock; and if the farm lies in the neighbourhood of an extensive common, the business of folding may be carried on to much greater advantage. The sheep which are best adapted to this purpose are those of the large Wiltshire or Hampshire breed. But these are not calculated for the purchase of the farmer who wishes to profit by his fold, and afterwards to fatten his flock on turnips; since it is great odds if he will be able to provide them with meat equal to maintaining them in the condition wherein he bought them, and by consequence he must ever discontinue his fold, or be content to see his flock dwindle, and become of less value the longer they are kept on the farm. But where the purchase is made with a view of penning them immediately on turnips, to fatten for the butcher, such large wethers may be very proper. Hampshire wethers are somewhat less than those of Wiltshire, and either these or the inferior kind of Wiltshire are best adapted for folding."

It is added, that "wethers are purchased by the husbandman of different ages, according as the œconomy of his farm may direct his views. If lambs are preferred, these are to be bought at the autumnal fairs, and will require to be kept a twelvemonth before much benefit can be expected from them, as the folding them at this early age, during the winter, might prove highly prejudicial to their growth. Four-tooth sheep, or two-yearlings, are likewise laid in at the autumn, and will come into work immediately. As to the six-tooth, or three-yearlings, and full-mouthed sheep, these are rarely, if ever, bought with a view to keep as stores; for, being arrived at their full growth, the profit to be expected from them, except for immediate fattening, will not be considerable; and when sold off in the succeeding winter, the owner must again have recourse to the like expedient of renewing his fold; which would occasion a considerable drain of ready money, and not fully answer his purpose. Whereas, by purchasing young stock, either lambs or tags, the original price is lower, and the loss of those which die by casualty will consequently be less severely felt: besides that these sheep, having been inured to the soil, will be found to go through their work with greater facility, and the hazard of their dying will be lessened in proportion to the time they hav been resident on the farm. For these reasons, t e farmer who keeps a wether-flock should make purchase either of lambs or tags. These tags, or two-tooths, are to be met with at the spring fairs, and may be folded, after having rested a few nights to recover themselves from the fatigue of the drift. A good shepherd is equally useful to a person who keeps a wether fold at work, as to the breeding farmer.

And now, supposing the winter fold to commence at Michaelmas, the sheep at this time are to be driven to and from the fold, at the same hours as was directed for the ewes, and when released in the morning should be turned to graze on the common, where they are to continue till two or three hours before the time of folding, when they are to be brought home, and baited on a piece of clover or other pasture, where there is plenty of herbage, that they may enter the fold with full bellies. As the grass on the common falls off, it will be proper to relinquish this pasture, and take the flock into the inclosures; such as old lays, clovers, &c. of which, by proper management, there will be always great store remaining on farms of any extent, where this mode of husbandry is pursued; and where there is not a large tract of arable land, that sheep-feed may be yearly raised in abundance, it will be useless to attempt it. These pastures then, by favour of the autumnal rains, we will suppose, have thrown

out a tolerable bite of grass by the time the flock is taken off the common; and from hence the sheep may be folded, till the state of the weather renders it necessary to remove them on the turnips, of which the writer likewise presumes there is no deficiency. From the turnip-field they may be driven every night into fold, till the further progress of the winter renders it necessary to discontinue this business. In folding wethers, it is prudent to take in a large compass of ground in the winter-time, as hath been before-observed in speaking of the ewe-fold. Racks filled with hay and pea-haulm should also be standing at this season within the fold. As there will be annually a number of the full-mouthed sheep drafted off for fattening, and as such forward wethers will have been some time on turnips, before it is necessary to turn on the store sheep, these latter may succeed the former wethers, and be made to eat up the hulls which they had left behind. As to the lambs, these should be always kept to a good and plentiful diet during the winter; by which management they will probably gain a larger size than they could have possibly reached if they had not been allowed a great plenty of meat whilst they were young. The same rule holds with colts, calves, and other young animals, which, if stinted in aliment during their growth, will always carry with them sufficient marks to denote this improper management throughout the remaining part of their lives. This being the case, it is evident that some of the best pasture and most prolific grattens should be allowed for the lambs till the turnips are ready for feeding, when this young stock ought to come in for their share of that root. By this mode of treatment they will make large tags in the next year, and prove a valuable addition to the fold. In buying lambs, which are hereafter intended to compose a folding flock, the purchaser will do well to be directed more by the size of the young creature, than by its corpulency. As the spring advances, the fat sheep will continue to be sold off, which will enlarge the circuit for the store wethers; so that on land in any degree kindly for the cultivation of turnips, a sufficient quantity of this root may be raised for the winter support of the folding flock. As to those sheep which are intended to be fattened, it must never be permitted for them to entrench too far on the provision of the flock; therefore, when the turnips are slight, it is found to answer better the interest of the farmer, to sell the full-mouthed wethers out of the fold at Michaelmas, than to suffer them, on the expectation of bringing in some ready money towards the spring, to devour the meat which ought to have been reserved for the flock, and without which the store-sheep will sink in flesh, and the farmer in the end will be considerably out of pocket in the prosecution of this scheme. When the turnips are eaten off, the flock may be turned on the rye; or if this feed hath got to a good bite in the month of February, which frequently happens in mild winters, and on land that is in tolerably good heart, the folding wethers may be occasionally shifted from the turnips to the rye-field, and, when they have eaten down this latter, be removed back on the turnips, and afterwards driven again on the rye when the blade shall have arisen to a second bite; observing that this food should never be allowed to stand till it begins to be on the spindle, for after that time it soon loses its succulency, and becomes unfit for this use. It is therefore in the early part of the spring only, whilst it continues in its herbaceous state, that rye is of any use for sheep-feed; and as in a forward spring it forms its spindle towards the beginning of April, it should seem that no material benefit can be derived from it after those winters which have been attended with a considerable length of frost, so as to prevent it from growing to a head for sheep-feed in the months of February and March; for it is in these two months when rye is of the greatest advantage. In very backward springs, however, rye may continue to be fed much later than the period here mentioned, and be found very useful at such times, when, from the ungenial weather in these late springs, the tare and clover-fields are sluggish in their vegetation.

"The whole of the fields of rye and turnips having been fed off, the ray-grass will by this time have formed a shoot, and afford a wholesome food, on which, with alternate removals to the old lays and young clovers, the flock will find sufficient pasturage till the time advances for turning them on the common, when the summer folding will commence. The lambs which were bought in at the last spring fairs are now become tags or two-tooths, and those which were bought in tags at Michaelmas are become four-tooths, or two-yearlings. These will now all of them go to the fold together, and feed in the same pasture, that is, on the common, during the day-time, and in the evening, previous to the time of folding, are to be baited on the clover, &c. that they may go into the fold with full bellies. At the spring fairs, tags may be bought to supply the place of those old sheep which were sold off, and these may conveniently go to fold with the rest; and if at Michaelmas it should be found necessary to increase the number, either lambs or two-yearlings may then be purchased at the option of the farmer; and by this management, if the master is cautious in laying out his money, and the shepherd diligent in his office, a wether stock may be maintained to great advantage on those farms where there is a considerable tract of land, and an adjoining common." And thus by observing to lay down the most sterile part of the land, and that which is at the farthest distance from home, with ray-grass, and when worn out to plough it up, and after having reaped one crop of corn to sow it again with ray-grass, and by folding on such part of the land which will admit of being kept in tillage, with alternate growths of clover, trefoil, &c. the poorest soils may be made to answer the purposes of the husbandman. And it is by the prosecution of this mode of agriculture alone, that such poor, thin, and hungry ground can be cultivated to any good account; for if the renter, either from the want of money or through ignorance, should neglect to keep

a folding flock on these barren farms, and place his whole dependence on the plough and the seed-cup, a few years would convince him of his error, and, unless his resources were very ample, bankruptcy and ruin would inevitably ensue.

Dr. Anderson, in the third volume of his Essays on Agriculture and Rural Affairs, observes, that much amelioration and improvement may frequently be effected in bringing waste land into cultivation by the folding of sheep, provided it be conducted with proper attention to the season, the nature of the land, the course of crops, and the having a sufficient number of folds, according to the extent and situation of the land. See *Sheep*.

FOLE-FOOT, a term provincially applied to colt's-foot. See *Colt's-Foot.*

FOMENTATION, in *farriery*, an application of the softening kind, used by means of hot flannels, which are moistened with it, and laid upon the parts, by which a warm steam is communicated to them, their vessels relaxed, and their morbid action alleviated or removed.

The following are improved *formulæ* :

Take of leaves of wormwood, two handfuls; bay leaves, rosemary leaves, chamomile flowers, each one handful: Boil these in three quarts of water to two; then add to the strained liquor, spirit of wine, four ounces.

Take of common mallow leaves, marshmallow leaves, each two handfuls; leaves of rue, one handful: Boil them in three quarts of water to two.

Take of marshmallow leaves, two handfuls; chamomile flowers, elder flowers, lavender flowers, and rosemary leaves, each one handful: Boil them in three quarts of water to two, and then strain.

And the following form by Mr. Denny is still more cheap and simple:

Take of chamomile flowers, dried leaves of wormwood, of each two handfuls; water, six quarts: Boil them for ten minutes: then strain, and add of vinegar, one quart.

The principal virtues of these remedies, probably, are in the heat and moisture which they afford.

FOLLOWERS, a term applied to such lean or store cattle or sheep as follow the fattening bullocks or other animals in the pastures. It is by this means that the pastures are fed down in the most effectual manner, and with the greatest advantage.

FOOD, a general name for such substances as are found to nourish and support either animals or vegetables. In the former, it is of various kinds, according to the intention of the farmer. See *Fodder*, *Stall-feeding*, *Team*, and *Horse*.

Food *of Plants*, the particles of different kinds of matters which they extract from the soil, air, &c. in order to their nourishment and support. Inquiries into the principles of vegetation, and the manner in which it is performed, are well worthy the attention of the cultivators of the soil, as upon a knowledge of this in a great measure depends, not only the improvement of the art, but the advantageous production of different sorts of crops. It is indeed necessary for the agricultor to have a full and complete knowledge of the means by which plants are best and most successfully raised. A just notion of this will greatly contribute to guide and assist him in the management of his lands, and to show in what state the earth should be, in order that it may afford the nourishment of plants in the most abundant, easy, and expeditious manner.

It is observed by Doctor Ingenhousz, in an ingenious essay on the food of plants and the renovation of soils, inserted in the thirty-seventh volume of the Annals of Agriculture, that the surest way of finding out the real nourishment of organized bodies seems to be, to inquire what is the substance without which they inevitably perish, and which alone is sufficient to continue their life. All animals require two ingredients for the continuation of their life; viz. atmospheric air, and moist food derived either from animal or vegetable substances; which food being received into the stomach, or some reservoir destined for that purpose, and being gradually digested and changed into different substances in the different organs, is applied to the whole œconomy of the animal body. Vegetables being deprived of progressive motion, by which means the most part of animals go in search of food, must find in the narrow compass of space they occupy every thing necessary for their subsistence. As they are in contact with two substances only, the earth and the atmospheric air, their nourishment must, he thinks, exist in either of them or in both. The earth is necessary to the plants, as the only means to fix them stedfastly to the spot, by spreading through it their roots; but as earth contains generally moisture, salts, air, &c. nature has taken advantage from this circumstance, so that the filaments of the roots pump from the soil all that is offered to their suckers, and can be absorbed by them: but as some plants may live and thrive without being in contact with any earth, we ought to take it for granted, that the soil, or what exists in the soil, is not the only food of plants. Water is necessary to all organized beings, as without it no circulation of juices could be carried on; but from this necessity it can only be deduced, that water is a vehicle of the food, and by no means that it is the true nourishment of animals or vegetables; the less so, as it is an incontrovertible fact, that several plants can live without being in contact with water. Thus the agave, cactus, aloe, cacalia, &c. live on the most dry rocks in the hottest climates, where it does not rain sometimes in the space of several months, and where the burning sun pierces all other plants, and even deprives the trees of all their leaves; and, what is extraordinary, almost all the parts of such plants are full of juices. The nocturnal dew, he supposes, cannot give sufficient nourishment to such plants, as all other plants would also maintain themselves with it. But to be certain that those plants do not subsist by dew, we ought to consider only that some plants of that spe-

cies may be kept alive in the hot-houses, either in pots, without being watered, or by hanging them up from the ceiling.

Now, as by what he has said here, it seems, he thinks, to be probable, that neither water nor soil is or contains all the true nourishment of vegetables, it must be concluded, that plants must find it in the atmospheric air; for this, he says, is the only ingredient without which all vegetables perish. A plant shut up *in vacuo* soon dies; and it dies in all sorts of aerial fluids which are incapable of supporting animal life: such as fixed air, inflammable air, phlogisticated air, or azote, &c. It is true, he remarks, that Doctor Priestley and Mr. Scheele have propagated a doctrine diametrically opposite to what he has here advanced, by saying that plants thrive wonderfully in putrid air, and perish in pure or dephlogisticated air. This doctrine, though generally adopted, and very ingeniously applied by Sir John Pringle and others to illustrate the mutual resemblance established by the author of nature between the vegetable kingdom and the animal creation, is, he conceives, refuted by his experiments, by which he thinks he has proved, that plants shut up in vital air live so much the longer, as this air is superior in purity to atmospheric air. In his Expériences sur les Végétaux, tome ii. he has explained the manner of making these experiments with success; and has shown the reason why, of two plants, the one shut up with common air, the other with the same quantity of vital air (both kept in the dark), the plant placed in common air can only be kept alive during a certain very limited time, whereas the plant shut up in vital air may be kept alive much longer, even as long as there is vital air enough remaining to cover the whole plant.

From these and many other considerations he has deduced, that from the two organised kingdoms, the animal and the vegetable, the animal derives its nourishment from the vegetable; but that the vegetable creation is independent of the animal world, provides for itself, and derives its subsistence chiefly from the atmosphere.

When he engaged in the experiments on vegetables, which he published in 1779 in English, and in 1780 more fully in French, Doctor Priestley had already observed, he says, that vegetables possessed a power of correcting bad air; which, however, was denied by Mr. Scheele, in Sweden, who found that plants, instead of correcting bad air, corrupted good air. This contradiction struck Doctor Priestley so much, that he employed the summer of 1778 in repeating his former experiments; and after the most accurate researches he concluded, that though there seems to be such a power in plants, yet that very often they have quite a contrary effect, as Mr. Scheele found; but that he did not know what the reason of this uncertain effect of plants on air was. In 1778 he found, by accident, that by exposing well-water a long while to the sun, it produced a filmy greenish sediment, which produced pure air in the sunshine: by examining this matter with a microscope, he found it destitute of organisation, and pronounced it to be neither an animal nor a vegetable substance, but a substance *sui generis*, to which he gave the name of green matter. Mr. Berthollet found also, that, by exposing dephlogisticated marine acid to the sun, vital air was produced; and Mr. Scheele, in Sweden, found, that the same air was also produced from nitrous acid exposed to the light of the sun. Doctor Ingenhousz says, that he was fortunate enough to discover the true reason why plants did sometimes correct bad air, and sometimes made it worse, which reason was never so much as even suspected by either of the above-mentioned philosophers. He discovered, in the summer 1779, that all vegetables are incessantly occupied in decomposing the air in contact with them, changing a great portion of it into fixed air, now called carbonic acid, which, being specifically heavier than atmospheric air, tends naturally to fall downwards, and, being miscible with moisture, salts, and different sorts of earthy substances, is apt to combine with them. He also found that the roots, flowers, and fruits, are incessantly employed in this kind of decomposition, even in the middle of the sunshine; but that the leaves and green stalks alone cease to perform this operation during the time the sun, or an unshaded clear day-light, shines clear upon them, during which time they throw out a considerable quantity of the finest vital air, and moreover make the air in contact with them purer, or more approaching to the nature of vital air. He has indeed stated facts, which prove that vital air, produced by vigorous plants in the sunshine, is of the greatest purity in itself; and that the air thrown out by them in the shade, or in the dark, is in itself—that is to say, being free from other air, the most active poison in destroying animal life yet known.

He did not doubt, but that this continual decomposition of atmospheric air must have a general utility for the subsistence of the vegetables themselves, and that they derived principally their true food from this operation, by changing this decomposed air into various juices, salts, mucilage, oils, &c. much the same as in graminivorous animals the simple grass changes, in the various organs, into the numerous and very heterogeneous fluids and solids. It would, however, he thinks, be a very difficult, if not impossible task, to give a clear and satisfactory theory, by which these various changes, compositions, decompositions, new combinations, &c. performed upon one single species of food, such as grass, may be explained. The same incomprehensible transformations are going on in vegetables. If once it was satisfactorily proved, that plants can subsist in what they find in atmospheric air without any other substance, we ought, he thinks, to content ourselves with the fact alone; for it would be in vain to attempt to penetrate the mystery of all the changes this air undergoes in the organs of these living beings; no more need we anxiously to investigate by what means, in a man who lives only on rice and water, all the various transmutations of this simple food are performed. This mystery is, he supposes,

above the reach of our very limited understandings. The new light which chemistry has received in our age, affords us, he says, the means of understanding many phænomena which we were either ignorant of, or which nobody understood any thing of before. The new discoveries in the nature of water, air, salts, &c. open the door to an infinite number and variety of new discoveries. The identity of the same principle of all acids called oxygen, which the French chemists have established, throws new light on the difference which exists in the various acids already known, and on the changes which these acids undergo. Thus the same acidifying principle, attaching itself to a different basis, becomes either nitrous, vitriolic, marine, or any other acid: with carbon it becomes fixed air, or carbonic acid; with sulphur it becomes vitriolic or sulphuric acid; with phosphorus it becomes phosphoric acid; with azote it becomes nitrous acid, &c. The last was a discovery made by Mr. Cavendish. It may thus, he thinks, be reasonably supposed that some acids taken into our body may lose in the various operations of our organs their former radical, and combine with a new one, and by this combination entirely change their nature. Without such-like changes taking place in our organs, how could we, says he, account for the generation of the great quantity of phosphoric acid existing almost every where in our bodies (which acid has already got the name, by some eminent chemists, of *animal acid)*, principally in our bones? whereas we find no where the marine acid, though of all others we take in the greatest quantity of it. We find in several liquids its bases, the fossil alkali; as in bile, urine, &c.; but we find nothing of its acid, nor even the marine salt undecomposed, except in the serum of the blood and the *chylus*, in which this salt has not yet undergone the elaboration of the vital organs. It seems, therefore, as if all the acids, the marine, the vegetable, the carbonic, &c. were in our organs transformed, for the greatest part, into the animal or phosphoric acid. It appears at least probable, that without supposing this change of acids to take place in our bodies, we could not account for the great abundance of phosphoric acid existing in our bodies; for though it really exists in some of our foods, yet the quantity of it is but trifling.

If, says he, plants imbibe fixed air, or carbonic acid, it is not more difficult to believe that this substance may be transformed, elaborated, or modified into various other substances and salts in the organs of the plants, than it is difficult to believe that the above-mentioned changes take place in the human body. Who could believe, without demonstrative proof, that the aerial fluid, the carbonic acid, constitutes about $\frac{40}{100}$ of limestone; and that this stone having lost its hardness, by being deprived of this aerial fluid, recovers its former consistency by recovering this fluid? As the carbonic acid is composed of the acidifying principle, the oxygen, and the carbon or coal, plants may derive from these two principles some of the most essential substances we find in them; their acids, their oils, their mucilage, &c. these ingredients, together with the azote absorbed also with the atmospheric air, being elaborated in their organs, variously modified and combined, in a manner somewhat analogous to the wonderful, though to the human understanding incomprehensible, elaborations and combinations which we observe in the bodies of animals. Mr. Hassenfratz's three papers on the nourishment of plants, delivered in 1792 to the Royal Academy of Paris, have met with very general approbation; and the principal part of the doctrine contained in them, viz. that *coal* or carbon *constitutes the principal nutritive substance of plants*, has been adopted by the celebrated Mr. Kirwan, in his Dissertation on Manures.

In the first he contends, that water and air are not alone sufficient to nourish plants, but that the developement or growth of these matters is owing to the *carbon*, which, being originally lodged in the seed, is expended in this business. In the second he attempts to prove that the carbonic acid or fixed air is not a nutritive ingredient of plants, and that the act of vegetation does not decompose the carbonic acid; but, on the contrary, this carbonic acid is, as Dr. Ingenhousz has discovered, formed by plants in the dark, and drawn from the plants and the oxygen of the water decomposed by vegetables. Mr. Kirwan, however, differs in this respect from Mr. Hassenfratz, and thinks that the carbonic acid is decomposed by the act of vegetation. In the third he asserts, that the carbon, the true nourishment of plants, is derived by the roots from the soil, where it is found ready in a state of sufficient solution or suspension to be absorbed by the suckers, and carried through the whole plant. He thinks that the vigour of the plants depends chiefly upon the quantity of carbon with which the soil is impregnated; and gives the name of carbon to the brown sediment of the infusion of dung which remains after the water is evaporated or conveyed away.

The doctrine contained in these memoirs, as well as the important experiments to which they relate, require, Doctor Ingenhousz thinks, farther investigation before it can be proved or clearly understood. The following hints and considerations may, he says, perhaps show the way towards the true mystery of the manner which nature employs to feed the plants. All seeds contain a certain quantity of food, by which the plant may be kept alive in the beginning of its growth; some have a considerable portion of mucilaginous matter, such as the seed of quince; some have, besides this mucilage, a very thick cover or pulp, by which the seed is surrounded, such as the seed of grapes, apples, pears, melons, cucumbers; which substances serve also as food for animals. All those substances by which many grains are thickly covered, yield a great quantity of fixed air, or carbonic acid, when the seed lodged in them begins to vegetate; but this substance being exhausted at the close of their fermentation and putrefaction, the embryo plants must be capable of providing for themselves. A new-born child may also live a few days without food, being nourished by some nutritious matter which it brings with it when born, and which it had imbibed by the mouth when

in the womb, and part of which nourishment was prepared in the pectoral gland of the child; as it is well known that all children, male as well as female, come into the world with a portion of true milk elaborated in their breasts. Thus also the yolk of the egg is drawn into the stomach of the chick when ready to break its prison, by means of which yolk it is nourished till it has acquired strength enough to go in search of food. The mothers of animals endowed with breasts, feed, during a certain time, their offspring by their milk. Many animals, such as birds of different kinds, wander about in search of food to be carried to their young. Very few animals find on the spot where they exist every thing they want. But all plants are destined by nature to remain on the same spot, and therefore must possess such faculties as prepare into food some of the substances in contact with them, as soon as they have consumed the small store of food they are provided with before they vegetate. As the very first decomposition of the pulp surrounding the seeds is accompanied with the production of carbonic acid; and the first operation of the embryon, or beginning plant, is to decompose the air in contact with it, by changing the oxygenous part of it into carbonic acid, of which it probably absorbs, in the dark and shade, the oxygen, and, in the sunshine, the carbon, throwing out at that time the oxygen alone, and keeping the carbon to itself as nourishment; as all these different operations have one general effect, viz. the decomposing the air in contact with plants, it seems more than probable, he thinks, that vegetables derive their principal food from this decomposition, and the production of fixed air, or carbonic acid. This supposition will, he says, acquire a degree of greater probability by considering, that all airs which cannot be easily changed or decomposed into fixed air, as possessing no oxygen at all, are true poisons to plants, such as inflammable air, putrid air, and azote, contrary to Dr. Priestley's and Mr. Scheele's doctrine; and that vital air itself, or an air approaching to its nature, maintains a plant remarkably well in its full vigour; and that carbonic acid concentrated, or without a great proportion of respirable air, kills also plants, as this air and all other airs, poisonous to vegetable life, are also destructive of animal life; which doctrine he offered first, in contradiction to that of the two celebrated philosophers just mentioned. Dr. Ingenhousz should, however, have proved the first position by experiments in opposition to those of Mr. Young and other inquirers, as the first has, he assures us, fed plants with inflammable air till they became, comparatively speaking, giants amongst dwarfs. How then, says he, does it act as a poison? If nothing else be given, it may, as the most nutritious food may, suffocate animals. Dr. Ingenhousz however remarks, that when he discovered, in 1779, that all vegetables decompose the common air by night, and change a part of it into fixed air; and when he drew from this, and some other facts, the conclusion, that the plants absorb this fixed air and turn it into their nourishment, the new doctrine of chemistry was not published; and being ignorant of all the beauties of that system, he was unable to reduce these facts to a proper theory: but since we have been instructed in the analysis of water and air, it is become, he thinks, much easier to explain the phænomena of vegetation. As it is now admitted, that fixed air, or carbonic acid, is composed of oxygen deprived of its caloric, or matter of heat, and of carbon, it is not difficult to understand how plants provide or prepare their own nourishment by producing carbonic acid, supposing it to be demonstrated that carbon is the principal nourishment of plants.

He further observes, that from this doctrine it would naturally be inferred, that plants must grow the most rapidly at such time as they prepare the greatest quantity of this nourishment, which is when they are in the dark; and this is just what really happens, as all plants grow with much more rapidity in a dark place than in the light, as Mr. Du Hamel and Mr. Bonnet, of Geneva, found. Plants in general grow less, he supposes, towards the middle of the day than at any other time; many do not advance at all when the sun is near the meridian; some even become manifestly shorter towards that time.

He has also discovered that the roots of plants, even when exposed to the sunshine, produce carbonic acid, but that the leaves and green stalks produce this acid only in the dark; and that flowers and fruits, with a few exceptions among the last, produce at all times, even at the roots, carbonic acid. Thus there is no time lost, some parts, or the whole plant, being constantly employed in this business of preparing carbonic acid. Though Mr. Hassenfratz seems to believe, that plants do not derive the carbon (in his opinion their true nourishment) from the carbonic acid, but find it ready made in the dung; the doctor thinks it more probable that plants derive it chiefly from the carbonic acid, which is a substance very easily decomposable into its two ingredients, viz. oxygen and carbon. All manures, but principally dung, produce a great quantity of carbonic acid either by themselves, or by decomposing the air in contact with them. But here, says he, seems to start up a difficulty, how a plant or manure can draw from the atmospheric air carbonic acid, as common air contains, according to the new system, only $\frac{1}{100}$ of it; and, according to M. Lavoisier, none at all. Though according to those principles it could not be accounted for theoretically, he thinks we have at hand facts enough, from which it seems evident, that the common air can by itself furnish all the ingredients for the composition of carbonic acid, as we shall see by and by.

It is observed, that we are as yet very far from understanding the various productions, which in this world are exposed to our senses as offsprings from the infinite combinations, decompositions, chemical affinities or attractions, &c. every where in action on the surface and in the bowels of the earth, in the atmosphere, the waters of the sea, and all others in the organized bodies of animals, vegetables, &c. The new system of chemistry, indeed, furnishes a vast deal of new light, but is yet by no means sufficient to penetrate into the deep mysteries of or-

ganized beings: for instance, the propagation of animals and vegetables has, he thinks, acquired from it but very little, if any, light at all. But to return to the subject of the production of carbonic acid. Calcareous stones and alkaline salts, deprived of all their carbonic acid by fire, regain it solely by the exposure to the open air. If this production can happen by such simple means, can we, says he, be astonished that organized bodies draw it from the same source, the atmosphere? which to him seems to be the general magazine or store-house of all the substances which enter into the composition of all organized bodies of the animal and vegetable kingdom, and even of many others of the mineral kingdom likewise.

He further remarks, that Mr. Du Hamel found that a branch of a vine, or any other tree, conducted within a hot-house, its root remaining out of its boundaries, will there shoot forth vigorous leaves, new buds, flowers, and produce fruit, when all the other branches remaining exposed to the open air show no signs of life, being, with the roots, benumbed by the cold, and probably destitute of any motion or circulation of their juices. If the growth of vegetables depended on the absorption of carbon by their roots, the branch drawn into a hot-house could not, he says, thrive at all, as long as the root and stem were benumbed by cold weather. But this branch being in contact with no substance but air, heat, and light, must derive from the surrounding air alone all its wants to perform all the operations necessary to its growth and propagation. By watching all its phænomena, it will, he says, be found decomposing the air in contact with it, but in a very different way by day and by night: and that it performs these transmutations of air chiefly within its organs, is the more probable, because all plants absorb the air in contact with them, with all its contents, and throw it out in a given time much altered from what it was at the moment it was drawn in. The period of time required by a plant to renew all the air it has absorbed, he found to be less than half an hour by day and by night. This last assertion, which he has demonstrated by facts, will, he observes, perhaps be looked upon by critical minds as somewhat paradoxical, as it seems difficult to conceive, that the same organized body can, at the same time, inhale and evaporate from the same surface the same fluid; but this double phenomenon being continually performed in all parts of living animals, the difficulty of understanding it vanishes of course. Though the most part of annual plants which afford good nourishment for men, such as wheat, rye, maize, will grow in poor soils, yet they do not become thriving in a luxuriant way but in what is called rich or well-manured soil. Those plants having a quick growth, when assisted by heat and the sun's light, come very soon to their term, or to the act of propagating their species, or of producing seed; which being come to perfection, the vital power of the plant is exhausted, and it dies. These plants being of a tender structure, and generally not spreading their roots deep in the ground, require the nicest attention in preparing the soil, so that the roots may find the least resistance in spreading, and also as much nourishment ready prepared for being absorbed by the roots as the plants want to become vigorous, and no more; as it is well known that too much manure, as well as too little, will prevent the plants from thriving. By want of manure the plant may, he thinks, be considered as starved, and by too much as choked with food. This may perhaps be considered, he conceives, as somewhat analogous to a chicken which will lay no eggs, or very few, by feeding it too little or too much: and it may be with plants, perhaps, as it is with animals, that too much food may be hurtful to both.

But, if carbon or coal be really the genuine food of plants, it seems to him doubtful, whether the brown mud remaining after an infusion of dung is evaporated, be real coal, before it has undergone an ignition. It ought rather, he thinks, to be called an extract, and may again be diffused through water, or dissolved as it was before the evaporation; but when it is burned into real coal, it is become almost totally insoluble in water, as all charcoal is generally well known to be. Charcoal is not only insoluble, but almost unalterable; incorruptible, possessing only when newly ignited an antiseptic power, which it recovers again by a new ignition; and he cannot help still doubting, whether real coal reduced even to impalpable powder possesses any manifest quality by which it deserves to be arranged among manures. The justly celebrated Mr. Arthur Young, having put this powder to the trial, found it had no beneficial effect at all on vegetation. Though there is no doubt but that vegetables draw in by their roots a good deal of food, yet he thinks, the principal business of feeding is carried on by the leaves in the atmosphere. Besides the fact of Mr. Du Hamel, described above, there are several other considerations which seem to give strength to this assertion. Many European trees, when stripped at once of all their leaves, will die. (Trees in very hot climates suffer the loss of their leaves by the scorching sun for a time in dry weather without perishing.) Doctor Ingenhousz was present at the following fact: the sulphurous smoke from burning a few pounds of antimony, mixed with nitre, was accidentally driven by the wind upon a very thriving large pear-tree, full of pears half ripe: next day he found all the leaves and pears fallen off, and the tree irrecoverably dead. A plant placed under a bell, with its root in a phial full of water, will, he says, die when the bell is exhausted by an air-pump; it will equally perish if, instead of respirable air, it be immersed in any air unfit for breathing animals. If the roots were the chief organs of feeding plants, their life might, he supposes, be supported in any of those airs, principally such as possess no acrimonious ingredient, such as pure azote; but pure azote will kill a living plant, and prevent seeds from vegetation. Respirable air, moderately warm, is alone sufficient to make a plant vegetate, without any light. He found even that seeds are hurt by a strong light, grow slowly, and are often killed before the two lobes are

become leaves, and their plumula or root is formed; and that, if they survive the action of light, they remain commonly but weak or deformed plants. This shows, he supposes, that in agriculture almost all seeds not covered will perish when the sun shines upon them at the time of their beginning to swell or vegetate. His experiments have, he thinks, proved sufficiently, that such seeds or embryo plants perish by the light only (which is insupportable to all very young plants, as well as plants weakened or sickened by transplantation), and not by the heat of the sun, or by want of moisture. When a plant is reared up in the dark, either under the ground or in a dark or shaded open place, to a certain degree of strength, light becomes more and more beneficial to it; not, however, for its advancing in size, but for acquiring strength, getting a lively green colour, and for its becoming fit for propagating its species, which propagation will not succeed without sufficient sunshine, or at least day-light and a due degree of heat; that is to say, the heat of the air, and by no means the heat of the soil; which last, though very beneficial to some plants, is rather hurtful to several: and indeed the ground being kept moist by watering, is always kept cool by the continual evaporation; and yet plants in general thrive very well in moist ground, though always kept cool. Trees in a forest spread their principal roots to such a depth as the heat of the atmosphere can never reach; their roots are, winter and summer, in an uniform temperature of 50-52 degrees of Fahrenheit's thermometer. This shows, he conceives, that the vegetation of trees, as is that of almost all plants, being stopped, or nearly so, during the winter, is revived by the heat of the atmosphere alone, without any regard to the heat of the soil, which is scarcely subject to any alteration but at the surface. The heat of the atmosphere alone, he thinks, sets the juices of trees into motion, which motion sets, by propagation also, the juices of the roots into the same motion: thus the juices drawn from the roots upwards empty the filaments and suckers, which by this motion upwards must naturally become powerfully absorbent, without any degree of heat being more necessary, for this absorption or attraction than is required for the suction of an ordinary pump. Boyle or Hales (if he recollects well) applying a glass tube to the trunk of a vine cut off in the spring, collected a very large quantity of juice pumped up by the roots, which motion of the fluids in vegetables depends greatly upon their irritability, according to Mr. Van Marum; which seems to be the more probable, as an electrical explosion directed through a plant, such as *euphorbia*, stops immediately all motion in its juices, by extinguishing the irritability. The roots thus absorbing the moisture presented to their suckers, take in, of course, all salts, earth, metallic substances, &c. that can be dissolved in water, or in the saline matter to be found in almost all waters. This solvent is found to be for the most part fixed air. Though we find some of these salts with all their characteristic qualities in some plants growing in a soil impregnated with them, as are many plants growing near the sea-shore which are full of sea salt; yet it is not less true, that most part of the ingredients imbibed by the roots, as well as by the leaves, trunk, and branches, undergo almost a total change in the organs of the plants, even so far as to produce in one plant a wholesome food, and in another, its next neighbour, a true poison. But, as he has proved before, that the atmosphere alone can furnish to some plants all that is wanting for all their functions, we ought not to look too anxiously among rubbish or dung for the true and natural food of vegetables, though in those substances a greater quantity of this food is at hand ready prepared and partly imbibed in the form of carbonic acid, mucilage, oily and saline matter, by which the plant is enabled to provide food for throwing out and nourishing more branches, flowers, and fruits. He thinks it difficult to conceive how a large tree finds, during centuries, nourishment on the same spot, on the supposition of Mr. Hassenfratz, that its principal food is coal; and that this coal is not derived from the decomposition of the carbonic acid (of which coal constitutes nearly one-third, according to Mr. Lavoisier $\frac{28}{100}$). That gentleman admits Dr. Ingenhousz's discovery as well founded, that plants produce carbonic acid in the dark; and that roots being always deprived of day-light are, of course, incessantly occupied with this business. There exists every where in the soil common air, and common air alone is, the doctor says, sufficient to furnish, as he has proved before, carbonic acid, even without plants. Thus there is no difficulty in tracing the source of this coal, and of conceiving how the largest tree finds, during centuries, that immense quantity of food it requires for its maintenance, growth, and abudant production of fruit or seed, all which is certainly derived in part from the soil; but, he still believes, chiefly from the atmosphere, by means of the leaves absorbing and decomposing the air in contact with them.

He observes, that the transmutation of common air into different solid bodies, such as plants, is a very ancient doctrine: Pythagoras and Epicurus took it, he says, for an undoubted fact; and Lucretius, who has adorned his poem *De Rerum Natura* with this doctrine, says, that air changes continually into different other substances, and that these are decomposed into air, which afterward returns again into the composition of the different bodies; and that if this incessant rotation did not exist, every thing in this world would have been changed into air, which, of course, would have been at last the only substance existing. Anaximenes also asserted that all bodies are made of air.

In a preceding page the doctor hinted at a new theory of a curious fact, viz. that plants accelerate their growth in the dark, and advance the least in the middle of the day (which is an observation of Mr. Gardini). Though this theory may perhaps be erroneous, yet, as it is supported on a real fact, he says further, that plants changing in the dark more respirable air into carbonic acid than they can digest, they throw out a large quantity of it, and thus render the air in contact with them less respirable,

and that in the day they absorb with the atmospheric air so much matter of heat and light, or caloric, furnished by the sun, that they cannot digest it all, and therefore throw it out as superfluous, combined with the oxygen, which has thus acquired the nature of vital air, which vital air, though not yet obtained by plants in its greatest purity, is, however, in itself, full as pure as that which we obtain from the best manganese, or any other ingredient. In a letter to Sir John Sinclair, in 1794, he quoted, as a proof of carbonic acid being the principal food of plants, the fact he discovered, that the wonderful apparatus which a plant produces when it is occupied with the propagation of its species, viz. the flower is incessantly producing carbonic acid. By this observation we may, he thinks, be led to the knowledge of the true natural food of vegetables; and it may be said, as a further illustration, that if we were desirous to know what is the natural food of some particular animals, one of the surest methods to find it out would be to observe what kind of nourishment the parents bring to their young. Thus we should find that a pigeon is best fed by grains, and a swallow by insects. By a similar conclusion, he infers that the true or principal aliment of plants is respirable air decomposed. By examining the air thus decomposed, he found it consisted of two substances, viz. of fixed air or carbonic acid, and phlogisticated air or azote; but as carbonic acid contains two distinct substances, viz. coal or carbon, and oxygen, it may be questioned which ingredient of the two is the real food we look for. Mr. Hassenfratz thinks it is principally coal; though his opinion is, that the plant does not derive the coal from the carbonic acid, but from the soil or dung. The doctor is, however, much inclined to think that both these substances serve as food: and he is moreover inclined to believe that the azote also enters the plant, and has also some share in feeding it. One of his reasons for thinking so is, that plants absorb continually the whole of the atmospheric air, and that in separating this fluid by decomposition into its constituent parts, they throw out that part of it which they cannot fully digest at the time it is produced, viz. at night the azote and the carbonic acid disengaged one from another, or only mechanically, not chemically, as formerly they were mixed, and in the sunshine the oxygen almost alone, the carbon and the azote remaining within the plant at that time. Though he thinks it probable that the azote enters, in some way or other, into the composition of plants, yet he supposes it is not absolutely necessary for a plant, as a plant thrives admirably well without it, viz. in pure oxygen. It is true, however, that plants also die in pure carbonic acid; but in this case the plant may be perhaps considered as if it were choked with it. He, however, acknowledges very readily, that the just-mentioned theory has not all the clearness he could wish to give it. The facts, however, quoted to support it, though contradicted during twelve years, are now, he says, admitted, even by those who have been the chief opposers of it.

The analogy which has been drawn by the late Dr. Darwin, in his "Philosophy of Agriculture and Gardening," between the manner in which animals and vegetables are nourished and supported, may perhaps contribute to render the nature of the food of plants still more clear and intelligible. He observes, that the various substances which constitute animal bodies, or which are found in the cavities of them, are composed from simpler elements by the processes of digestion and sanguification, and secretion; for it is well known that even milk, which so much resembles the chyle of animals, is not absorbed by the lacteals without its being previously coagulated, and again dissolved in the stomach by the power of digestion. Hence it happens, he says, that the chyle of all animals, and from every kind of food which they take into their stomachs, is very similar; and like milk consists of water, sugar, mucilage, and oil; the last of which not being soluble in water, but only miscible with it, gives it its opaque white colour. But that though the chyle from different kinds of aliment is so similar, and all the various constituent parts of animal bodies are ultimately produced from the chyle by sanguification and secretion, yet it happens that some kinds of aliment possess a greater quantity of these particles, which make chyle, than other kinds of aliment—such materials for instance as already contain much sugar, mucilage, and oil, as the flesh of dead animals, or the fruits and seeds of vegetables of different kinds. But besides the water, sugar, mucilage, and oil, which exist in chyle, there may, he supposes, be other materials, which are invisible from their perfect solution in water, either alone or when converted into acids by the addition of oxygen; as carbon, phosphorus, calcareous earth, marine and ammoniacal salts; though it is more probable that the two last are formed and secreted by animal processes, as well as selected by their absorbent roots, as they are more compounded bodies than the former kinds.

And similar to this chyle of animals is, says he, the sap-juice, which is absorbed from the earth by the roots of plants, constitutes their nourishment, and consists of water, sugar, and mucilage, with other transparent solutions, as of carbon, phosphorus, and calcareous earth. And though it has been proved by the experiments of some philosophers, that vegetables can extract or compose all these substances from air and water alone, yet some materials contribute more to the production of this vegetable chyle or sap-juice than others, such as the recrements of dead vegetable and animal substances in general.

"If," says he, "any one should ask, what is the food of animals? I should answer, that in the most early state of animal life the embryon lives on a mucilaginous fluid, with which it is surrounded, whether in the egg or womb: that in its infant state the young animal is sustained by milk, which its stomach converts into chyle or nourishment: and that in their adult state animals are sustained by other vegetable or animal substances taken into their stomachs, which are there converted into chyle, partly

by a chemical and partly by an animal process; as by a mixture of gastric juice with water and heat, some of these recrements of organic nature are decomposed, either into their simpler component parts, or sometimes even into their elements; while other parts of them are only rendered soluble or miscible with water, and are then drunk up by the absorbents of the stomach and intestines. In this process of digestion much sugar is produced, which is probably immediately selected and drunk up by the numerous months of the lacteals, or lymphatics, to which it is presented by the virmicular or peristaltic motions of the stomach and intestines. And as this ready selection and absorption of the sugar, as soon as it is formed, prevents it from passing into the vinous or acetous fermentation, it is probable, that from the want of such a means of separating saccharine matter, as soon as it is formed, chemistry has not yet been able to produce sugar from its elements without the assistance of animal digestion or vegetable germination."

He further remarks that, in this process of digestion, he believes a great part of the water, sugar, mucilage, and oil, which exist in vegetable and animal recrements, are not decomposed into their elements, but absorbed by their being soluble or miscible with water; the carbon, the phosphorus, and the hydrogen, are also, he supposes, dissolved in the other fluids by means of oxygen, and form a part of the chyle, without their being converted into gasses; for, when this happens to any excess in respect to carbon, it escapes from the stomach in eructations; and the same occurs to the inflammable air or hydrogen, if a part of the water becomes decomposed in the intestines; which, if it be not absorbed by its solution in other fluids, but acquires a gasseous state, is liable to escape below; though both these gasses seem occasionally to revert to a fluid state from their aerial one in the stomach or intestines, and to be then capable of being absorbed by the lacteals or lymphatics.

"What then," says he, "is the food of vegetables? The embryon plant in the seed or fruit is surrounded with saccharine, mucilaginous, and oily materials, like the animal fœtus in the egg or uterus, which it absorbs, and converts into nutriment: while the embryon buds of deciduous trees, which is another infantine state of vegetables, are supplied with a saccharine and mucilaginous juice prepared for them at the time of their production, and deposited in the roots or sap-wood of their parent-trees, as in the vine, maple, and birch; which saccharine matter is soluble and miscible with the water of the surrounding earth in the subsequent spring, and is forcibly absorbed by their root-vessels, and expands their nascent foliage."

It is therefore observed, that in their infantine state there is a wonderful analogy between plants and animals; and it is particularly curious to observe, in the process of converting barley into malt by the germination of the seed, that the meal of the barley is in part converted into sugar by the digestion of the young plant exactly as in the animal stomach. The wonderful effect of vegetable digestion in producing sugar may, he says, be deduced from the great produce of the sugar-cane, and of the maple-tree in America: and the wonderful effect of animal digestion in producing sugar, appears in patients who labour under diabetes.

We now, he says, come to consider the food of adult plants; and in this consists the great and essential difference between the nutritive processes of animals and vegetables. The former are possessed of a stomach, by which they can in a few hours decompose the tender parts of vegetable and animal substances by a chemical process within themselves, conducted in the heat of ninety-eight degrees, with a due quantity of water, and a perpetual agitation of the ingredients; which both mixes them, and applies them to the mouths of the absorbent vessels, which surround them. Whereas a vegetable being having no stomach, is necessitated to wait for the spontaneous decomposition of animal or vegetable recrements; which is indeed continually going on in those soils and climates, and in those seasons of the year, which are most friendly to vegetation; but is in other situations, and in other seasons, a slow process in a degree of heat often as low as forty of Fahrenheit (in which the rein-deer moss, *moschus rangiferinus*, vegetates beneath the snow in Siberia), and often without an adapted quantity of water to give a due fluidity, or any mechanical locomotion to present them to the absorbent mouths of their roots; or in still worse situations adult vegetables are necessitated still more slowly to acquire or produce their nutritive juices from the simpler elements of air and water, with perhaps the solutions of carbonic acid and calcareous earth, and perhaps of some other matters, with which one or more of them abound. See *Air, Water, Carbonic Acid, and Calcareous Earth.*

But it is remarked that M. Hassenfratz found, that the vegetation of those plants was imperfect which had not been suffered to grow in contact with the earth; as they never arrived at such maturity as to produce fruit, and were found on analysis to contain a less portion of carbon than other plants of the same kind. The experiments were tried on hyacinths, kidney-beans, and cresses. Hence, the doctor says, the other great difference which exists between these two extensive kingdoms of nature is, that the larger and warmer-blooded animals certainly (and, he supposes, all the tribes of insects, and of colder-blooded creatures also) cannot exist long on air and water alone, except in their state of hibernal torpor. The nearest approach to this is, however, he thinks, seen in some fevers, where water alone has been taken for a week or two, and yet the patient has recovered; and there is a well-attested account of a numerous caravan, which, having lost their route or their provisions, are affirmed to have lived some weeks on gum-arabic and water alone.

Vegetables, on the contrary, as above-mentioned, can, he conceives, exist, though in a feebler state, on water and air alone, with the carbonic acid, and perhaps other invisible solvents, which those ele-

ments unavoidably contain. This he supposes to be owing to the low degree of heat which they produce internally, and to the slow circulation of their blood; from both which circumstances less nutriment is expended, as by animals which sleep during the winter-season.

It is therefore suggested, that, for the purpose of supplying adult vegetables with nourishment, we should first consider what kinds of matter are most prevalent or most necessary in their composition. Secondly, what of these substances they can absorb without previous decomposition. Lastly, how to expedite the decomposition of vegetable and animal substances on or in the soil, like the digestive processes in the stomachs of animals: we may thus, it is supposed, become acquainted with the sources and the management of manures. See *Manure*.

FOOT, that part of an animal that affords it support on being placed upon the ground.

Mr. Coleman, in his Observations on the Structure of the Horse's Foot and Shoeing, says, that the best and most natural form of the foot is that where the bottom approaches to a circle; as a foot of this form is more adapted to the support of a great weight, than that of a sharp, oblong, contracted foot. Besides, in proportion as the hoof is long at the toe, the horse is more liable to trip. See *Hoof*.

But though a horse may have a very well made and well proportioned foot, if it chance to be thin it will not be a good one, as such a foot is liable to be spoiled in shoeing, by travelling on hard stony grounds, by too much drought in hot seasons, and by too much moisture in winter. A thin foot is that where the crust or horn is thin; this may be easily seen when the shoe is taken off, because the verge all round the sole will appear thin, and the horse will wince with the least touch of the pincers; but as this trial will seldom be allowed of, the best way is to observe the bottom of the crust, which is generally ragged, and where the shoe-nails are clenched and rivetted: if these be high, it is a sign that the foot is thin, and that there has not been sufficient hold for the nails, without driving them a good way upwards in the crust In this sort of foot, the heel and frog are also apt to be soft and tender to the touch, and, by reason of their weakness, to sometimes turn away, one point of the heel standing higher than the other, though this may also occasionally happen where the foot is tolerably strong. It mostly causes the horse to cut and go lame.

A very strong foot is likewise sometimes liable to accidents. In this sort of foot the fibres of the hoof are very distinct, and for the most part run in a straight line from the coronet to the toe, like the grain of hard woods. Some such feet will last very well, and keep free from accidents, where sufficient care is taken to keep them moist and pliable; but where they happen to be neglected, or the horses have much hard riding on dry stony grounds, or when they stand long in a hot dry stable, they will go lame and tender, though no defect is to be seen in the foot, the injury arising from the pressure made by the hard parts. Feet of this kind are not easily restored to a proper state. In these cases some instances have been known, where the hoof and the sole have been quite loosened from all their attachments to the foot, the fibres that unite the horny part to the flesh being torn asunder by the thickness and strength of the horn. Where this happens in any degree, it is apt to leave a tenderness behind, unless great care be taken to prevent it. But the greatest inconvenience in this sort of foot, is its being subject to *refts* and *fissures*, which cleave the hoof quite through, sometimes from the coronet down to the bottom. It is more liable to be affected with these, where the horny fibres have a straight direction, than where the foot is soft and pliable. As these clefts are for the most part in the quarter, they seldom admit of any other remedy than extirpating the whole piece that lies next the heel; which defect is from thence called a *false quarter*, as the cure is seldom so perfect, especially in the fore feet, as to leave no infirmity or blemish behind. When the fissure or cleft does not penetrate through the horn, but makes a line on the surface, it is called a *sand-crack*, being common in some sandy countries, from the horse's hoofs turning dry, and cracking with the heat of the sand. These are but little regarded where the lines are superficial, and are often cured by rasping the foot, and keeping it cool and moist. However, it is a defect that lessens the value of a horse, in proportion to the degree of goodness or badness of his foot in other respects.

Having the heels too narrow or too much contracted, is also a defect in the foot of a horse, that is not only difficult to remove, but which often lays the foundation of other complaints. In short, the feet of horses, to be good, should be as equal in size as possible, and not too flat or disproportionately large in any respect.

Fat Foot, in *horsemanship*, is when the hoof is so thin and weak, that, in shoeing, unless the nails be driven very short, the horse runs the risk of being pricked.

Foot-*Halt*, in *farriery*, a disease in sheep which is often very troublesome, but which is not yet fully understood in its nature or methods of cure.

Foot-*Paths*, such walks or paths as are made in fields, by walking through them when the land is under the plough, or shut up for the purpose of hay: they are frequently highly injurious to the farmer, from the mischief that is done in passing along them. See *Paths*.

Foot-*Rot*, in *farriery*, a disease in sheep, mostly arising between the claws of the fore feet, with a slight inflammation and swelling. It causes the sheep to be lame, and a degree of moisture oozes out between the claws, which has a highly disagreeable smell, and as the disease becomes more inveterate, it gets under the hoof, producing proud flesh. It has been often supposed to be infectious, on account of its spreading with such rapidity when not promptly removed. The long-woolled and Marino breeds of sheep are very subject to the disease; but other sorts of sheep also suffer from it.

In its cure, the part affected should be pared and

well cleaned, without cutting into the quick; and afterwards a solution of the following substances dropped upon it, the foot being wrapped up so as to keep it free from dirt:

Take two ounces of blue-vitriol, the same quantity of roach alum, one ounce of verdigrise, and a quarter of an ounce of muriated quick-silver; dissolving them in a quart of good distilled vinegar.

Others, however, make use of another caustic substance, the *butter* of antimony, which is applied to the part by the point of a small skewer, after being prepared as above. This is found to be a very effectual remedy.

It is a good method to separate the sheep thus affected, from the rest of the flock.

The change of the sheep into a more short dry pasture, is likewise said to be useful in these cases. See *Sheep*.

Foot-*Trenches*, a term signifying small superficial drains, about a foot wide.

FORCEPS, a term used to signify a pair of tongs or nippers. Implements of this sort are often used in weeding corn and other crops sown in the broadcast method; also for several other purposes.

FOREHAND, in *horsemanship*, that part of the animal which is before the rider.

Forehand *Rent*, such as is paid before entering upon, or deriving profit from the farm.

FOREHEAD *of a Horse*, the front part of the head. To be handsome, it should be somewhat broad: some would have it a little raised; but a flat one is most beautiful. And a horse should have in his forehead what is termed a *feather*; and a star or blaze is likewise desirable.

FORE-*Flank*, a term applied to a point in cattle.

Fore-*Legs*, those situated next to the chest. They should be straight, and well formed in the joints.

Fore-*Thigh*, a term denoting the arm of a horse or other animal. It is a point not much attended to in cattle.

FOREST, a tract of ground covered with and appropriated to the raising of timber. After observing that there is a great deficiency of timber in the forests belonging to his majesty, and highly blaming the management of them, the author of Modern Agriculture says, that, while the royal forests remain subject to the forest laws, it is in vain to expect that any improvement in the mode of management will ever take place. The objects of the parties more immediately concerned are so inimical to the prosperity of the forests, and so opposite to the public interest as to render every attempt nugatory, without the intervention of the legislative authority. By that alone, says he, can the forest laws be abolished; and the officers declared, what they really are, neither necessary nor useful. See *Timber*, *Wood*, and *Coppice*.

FORESTALLING, the practice of buying up largely any article of prime necessity, such as grain, fat cattle, sheep, &c. with the view of enhancing its price, in order to re-sell it in the same place to a large profit. It is a practice that prevails too much near large towns, in most situations where the consumption is great, and which ought to be prevented by the enforcing of the laws concerning it.

FORGE, a term applied to the furnace used by a farrier in heating the iron intended to form a horse's shoe.

FOSSE, a large ditch or moat; also a water-fall.

FOSSIL, a substance formed within the bowels of the earth, or near its surface, and which is of a simple structure. Fossils are of many different kinds, some of which are used in the arts, and others may be beneficial in agriculture.

Fossile-*Coal*, an inflammable material formed from the remains of antediluvian vegetables, the juices of animals, and mineral or metallic substances, mixed and combined with various earthy matters. It is capable of being rendered soluble by saline substances. See *Coal*.

FOSTAL, a way leading from the main road to a farm-house.

FOUL *in the Foot*, in *farriery*, a frequent affection in the feet of cattle. In this disease the animal appears very lame, and by examining the foot a crack will be found in it, with an offensive discharge proceeding from it. In order to its removal, first scrape it with a sharp knife, and clean it well; then dress it with a little butter of antimony once a day, keeping the beast from going into the water, and a cure will be effected in a few days. But when it is the swelled foul, the beast is in great pain, and the foot is swelled very much, and the claws spread out one from the other wider than usual; and when not attended to, it breaks out near the fetlock-joint. In this case, Mr. Downing advises the following poultice to be applied:

Take of ragwort and brooklime, each two handfuls; pound them in a mortar down to a pulp; then add as much wheat-flour as will make it of a proper consistence.

When it should be spread on some linen cloth, and be applied to the swelled foot. This dressing should be repeated every day. See *Cattle*.

Foul-*Evil*. See *Evil* and *Garget*.

FOUL-FEEDERS. See *Appetite*.

FOUL-FEEDING, in *farriery*, a voracious appetite to which some horses are subject, and, though not properly a disease, it is often the cause of various maladies. It is generally the effect of some latent distemper, as vermin, which have a very different effect on some horses to what they have on others; as horses of a lax habit of body often lose their appetites by worms, and are frequently griped and sickly in their bowels; while horses of strong rigid constitutions, that can bear the irritation of those animals in their intestines, are often voracious in their appetites, and continually craving after food. Foul-feeders, however, differ in some things from those that have voracious appetites: for, as the latter crave only after their common food, and can hardly ever be satisfied, so the former will leave their hay to eat their litter, and seem to like it the better when it is well saturated with their own dung and urine; and therefore they may be properly said to

have a vitiated or depraved appetite. Though this does not always proceed from a voracious appetite, yet the former is often productive of the latter, and may probably be occasioned by enlarging the capacity of the stomach and intestines to such a degree, that nothing will satisfy their cravings but what has weight and solidity; for the same kind of horses will eat mould and wet clay, or any kind of foul nasty weeds out of the ditches, and in the stable will eat stinking musty hay, which the generality of horses refuse. There are other horses of depraved appetites, that are neither foul nor voracious feeders, such as we often observe eat dry loam or mud out of the walls, which perhaps denotes some vitiated condition of their stomachs: and this also is frequently owing to vermin, or at least to a bad digestion, though perhaps not to any imbecility in their constitutions; for though these horses have a longing for those extraneous things, yet their appetites at the same time seldom fail: but as this is often owing to full feeding, with the want of sufficient exercise, so we often see them recover, and quite lose that vitiated taste, when they come to ride a journey, or go upon any other constant exercise. The best method in all these cases is to begin with purging, and to dissolve chalk in their water, and afterwards to give them good exercise. The same method may be complied with to those that feed voraciously. To these the following draught may also be given, to blunt their appetites:

Take of the roots of marshmallows, a large handful; of cummin-seeds, and fenugreek-seeds, each an ounce; liquorice-roots, sliced, half an ounce; boil them in three pints of water, till the roots are soft and slimy; then pour off the decoction, and dissolve it in an ounce of gum-arabic, and add four ounces of linseed-oil.

Give the horse four ounces of this decoction every morning fasting, till his appetite abates. The stalls should be kept as clean and free as possible from wet litter in all cases of this sort, as the horses are very apt to eat it.

FOULMART, a term sometimes applied to the pole-cat.

FOUNDERING *a Horse*, a term applied to the spoiling horses by over-riding, or working them too hard.

Foundering *in the Chest*. See *Chest-Foundering*.

Foundering *in the Feet*, in *farriery*, a distemper affecting horses in consequence of hard riding or labour, or by heats and colds, which disorder the body, so as to cause a numbness in the feet, without any sensation or feeling.

Horses may likewise be foundered by wearing straight shoes, and by travelling too much upon hard ground.

It may be easily known whether they are foundered on the fore or the hind feet, by the manner of their going, as they always avoid as much as possible pressing on the feet that are thus diseased. The method of cure is by taking off the shoes, and allowing the horses some length of rest.

FOWL, a general name applied to the larger sorts of birds, and used in a more particular sense to signify such as are bred in the farm-yard for profit. They are also distinguished into *land* and *water*-fowls, as hens, turkeys, &c.; and geese, ducks, &c.

The farm cannot be said to be completely stocked without fowls; besides, they may afford a considerable advantage by their eggs, brood, bodies, and feathers, in many instances, especially where the farms are of the arable kind, and near good markets. Of the hen kind there are many varieties, but those that are the best breeders and the best layers are to be chosen, the oldest being always the best sitters, and the youngest the best layers; but no sort will be good for either purpose, if they be kept too fat. The best age to set a hen for chickens is from two years old to five; and the best month to set them in is February, though any month between that and Michaelmas is good. A hen sits only twenty days; but geese, ducks, and turkeys, sit thirty. While they sit they should constantly have meat and drink near them, that they may not straggle from their eggs, and chill them. One cock will be sufficient for ten hens.

If fowls are fed with buck or French wheat, or with hemp, canary, or millet-seed, it is said they will lay more eggs than ordinary; and buck-wheat, either whole or ground, and made into paste, is a grain that will fat fowls very speedily; but the common food to fat them with is barley-meal, wet with milk or water; but wheat-flour and boiled potatoes are probably better. In order to obtain the utmost profit from them, a proper house and small paddock should be set apart for their reception, and care be taken that they are regularly fed, and kept sufficiently warm during the winter season. See *Poultry*.

Fowl's *Dung*. See *Hen-Dung* and *Manure*.

FOX, a well-known animal of the canine kind. As this animal is apt to destroy lambs, poultry, geese, &c. especially in farms that are near forest-woods and covert places, he should therefore be attentively watched, and taken as frequently as possible by traps or other means.

FOX-TAIL *Grass*. See *Alopecurus* and *Cow-Wheat*.

FREE-MARTIN, a term signifying a barren heifer, that has been a twin with a bull-calf.

FRENCH *Barley*, a sort of barley which is naked, the grain being like wheat, but the ear shaped like that of the common barley. It is said to yield a large increase, and make good bread and malt. By some it is called *wheat-barley*. See *Barley*.

French *Bean*, a sort of bean for the most part cultivated in the garden. It may, however, be grown with advantage in the field, where the soil is sufficiently good and mellow. See *Kidney Bean*.

French *Nuts*, a term signifying wall-nuts. It also signifies brushwood.

FRET, in *farriery*, a name sometimes applied to the gripes or colic in horses or other cattle. See *Colic* and *Gripes*.

FRICTION, a mechanical term used to express that resistance and wearing which arises from the rubbing of bodies against each other. It should of course be lessened as much as possible in the construction of all sorts of implements, as by that means a less power in the draught is required. In *farriery*, it also signifies the rubbing any part, in order to dislodge obstructed humours, or promote a free motion of the juices. To animals this is of great service, and may contribute to the prevention, and even the cure, of several diseases, especially such as proceed from a stoppage of insensible perspiration, or an obstruction of the cuticular pores, or those on the surface.

FRIM, a term used to signify any sort of vegetable which is full of juice. Hence it is often applied to grass and grain while young, and in a tender state.

FRITH, an arm of the sea running into the land.

FROG *of a Horse*, in *farriery*, the tender horny material that rises in the middle of the sole of the feet of horses, and which, at some distance from the toe, divides into two branches, stretching towards the heel in the form of a fork. It is stated by Mr. Coleman, in his Tract on the Formation and Uses of the Natural Frog of the Horse, that it is placed in the centre of the sole, externally convex, and of a wedge-like form, pointed towards the toe, but expanded as it advances to the heels. That in the centre of the broad part there is a fissure or separation. That the outward frog is connected, internally, with another frog, of a similar figure, but different in structure. That the external frog is composed of soft elastic horn, and totally insensible. But that the internal frog has sensation, and is much more elastic than the horny frog; and at the extremity of the heels is connected with two elastic substances called cartilages. The toe of the sensible frog is united to the coffin-bone; but more than nine-tenths of both frogs are behind the coffin-bone. The toes of the sensible and horny frogs, from their connexion with the coffin-bone, are, he says, fixed points, and have no motion; but the heels of the frogs being placed posterior to the coffin-bone, and in contact with moveable, elastic (and not fixed or resisting) substances, a very considerable lever is formed; and that whenever the horny frog comes in contact with the ground, it first ascends, and then descends. The pressure of the ground also expands the horny frog, and the sensible frog expands the cartilages, and, at the heels and quarters immediately below the hair, totally governs the direction of the future growth of the crust. This ascent of the frog, he adds, not only by its wedge-like form preserves the heels and quarters from contraction, but affords to the horse an elastic spring, and prevents the animal from slipping whenever it embraces the ground. Without any anatomical inquiry into its internal structure and union with other parts, the shape and convexity of the horny frog, he thinks, clearly demonstrate that it was formed to come into contact with the ground. And the more he has investigated the subject, the more he is convinced that the use of the frog is to prevent the horse from slipping, to preserve the cartilages and hoof expanded, and, by its motion, to act as an elastic spring to the animal.

But Mr. Saintbel and many others were of opinion, he says, that the use of the frog was to serve as a cushion or guard to the tendon of the flexor muscle of the foot. Where this opinion prevails, it is very natural to conclude, that art should endeavour to raise the frog from the ground by a thick-heeled shoe, in order to guard the tendon from bruises. But if it be a truth that this projecting body was intended to receive the pressure of the ground, then it will follow, as a law of nature, that, unless the frog performs its functions, it must become diseased.

The human legs are formed to move and support the weight of the body; but if they are kept in a horizontal posture, in a state of rest, the whole machine will soon become enfeebled and diseased. The horse is an animal intended for active life; but if he is suffered to remain without motion, not only his legs, but his whole system becomes affected. Indeed, common observation clearly proves, that no animal, or any part of any animal, where the natural functions are perverted, can be preserved in health. As the health and functions of animals can only be preserved by the proper exercise of them, he supposes that, if the real œconomy of the frog had been equally well understood, it would have been thought as necessary, for the health of that organ, that it should receive pressure, as we know it to be important for the health of the horse to have motion. It is therefore as great an act of violence to the frog, to raise it from the ground, and must as necessarily produce disease, as to deprive muscles of action. That the frog was not made to defend the tendon, can be demonstrated. There is no medical man, acquainted with the structure and œconomy of tendons, but must be convinced that the frogs of horses are formed for other functions. It has been proved by experiment, that the substance of tendons in health has no sensation; and, consequently, that one insensible body (*viz.* the frog) cannot have been made for the purpose of protecting another organ void of feeling. Again, the frog being made of a wedge-like form, a great part of the tendon is not covered by the frog, and more than one-half of it projects behind the tendon. If the frog had been made to act as a cushion, to save the tendon, then its shape and magnitude would, he conceives, have been exactly equal to the tendon.

As the practice of shoeing very much depends on the functions of the frog being understood, if the opinions here advanced respecting its uses be well founded, it must follow, he says, that paring the frog and raising it from the ground annihilates its functions, and ultimately, if not immediately, produces disease; and that exposing the frog to pressure is the only proper method to keep it in health. Moreover, it has from experience been ascertained, that, unless the frog sustain an uniform pressure when at rest, the heels as well as the frog contract; but if that organ be in close contact with the ground, then

it spreads, and is free from thrushes and canker, and operates as a wedge to keep open the heels of the hoof. The same degree of perpendicular pressure, or that pressure which the frog meets with from the ground, applied to the insensible frog, that produces only pleasant sensation to the sensible frog when in health, creates exquisite pain when diseased. It is therefore of great importance to preserve the frog sound; for, when contracted, or cut, or inflamed, it becomes highly susceptible of every impression: we might, he thinks, with as much wisdom contract the shoe of the human subject, or remove the skin of the foot, when obliged to walk on stones without shoes. Granite and other hard substances give no pain to a frog exposed to constant pressure in the stable; but when above the pavement, it generally becomes contracted, and the sensible frog inflamed, and then one stroke from a projecting stone will produce pain, perhaps lameness, while perpetual perpendicular pressure is attended with salutary effects in every instance.

It is further observed, that those who conceive that the frog is not made to come in contact with the ground, and with that view cut the frog, to diminish its convexity, and employ high-heeled shoes for its protection, would do well to consider, whether their practice is in truth conformable to their own principles. If it be true that no shoe, however high at the heel, applied to any hoof, can prevent the frog from occasional pressure, then it must follow, he thinks, that the practice and principles do not agree; and it is obvious that no frog is totally exempt from pressure, even if the shoe be turned up two inches at the heels. Where the roads are covered with a convex pavement, or with loose stones, the frog is liable to be struck by every stone that exceeds the thickness of the shoe; and in other situations, where there are no stones, the cavity of the shoe is filled with earth; so that the frog, when the horse moves, is exposed to unequal surfaces, and consequently receives frequent pressure. It therefore becomes, he says, a question, whether repeated blows on a part that has been raised, on the average, five-sixths of the twenty-four hours above the ground of the stable, and from the absence of pressure made very susceptible of impression, will produce more pain, and more disease, than constant and uniform pressure upon it.

When, says he, a sharp stone comes in contact with a soft and thin frog, horses are liable to fall. It may therefore be imagined, that if a horse feels pain from pressure of one blow, great mischief must ensue when the same cause is many times repeated; and that the effect or disease must increase in proportion to the cause. But it has not been considered, he says, that in consequence of always standing on the frogs on hard surfaces in the stable, these organs retain their natural insensibility and elasticity, and resist even the hardest bodies without the least irritation. This is evident from what takes place in the hands and feet of mechanics, and those that travel much. If the hoof of the horse was always exposed to natural air and moisture, and the frog to irregular surfaces, the form of the shoe would, he thinks, be of less consequence. But as in the stable the frog is very generally raised above the ground, the artificial heat tends powerfully to contract the heels of the hoof. When the hoof contracts, the frog must also become contracted, and inflammation and a suppuration follow, called a *thrush*. No contraction, however, takes place, he says, where the frog is made to receive constant pressure, as the standing perpetually on that wedge increases its growth, presses upward the sensible frog, and expands the cartilages of the hoof. And as the first shoot of the crust at the coronet is very thin, the direction of its fibres will be altogether regulated by the width of the cartilages immediately below the hair at the quarters and heels, and the cartilages will be always more or less expanded, and the hoof more or less circular, as the frog has more or less pressure. On that principle he long since recommended a shoe with thin heels, as the best formed shoe to bring the frog on the same level; and with great truth he can assert, that although, in some instances, from a sudden misapplication of the thin-heeled shoe to improper feet, he has seen the tendons affected, yet from all the experience he has since had, and from all that he has seen or heard of the practice of others, he knows of no instance where the frog, from constant pressure, did not expand and receive great benefit. Neither is it true, says he, as has been asserted, that the frogs of horses, from the pressure of the ground, are made *inelastic*, and incapable of motion. It is as totally contrary to the invariable laws of nature, that an organ should, in consequence of performing its natural functions, become diseased, as it is an invariable principle, that an organ deprived of its functions cannot continue in health. He has particularly examined the structure of many hundred frogs in hoofs shod with various shoes, and he has uniformly found, that, in proportion as the foot is contracted, it becomes hot and inflamed; and if the frog be not destroyed by *thrushes* or *canker*, it is brittle and inelastic. But where the frog has been constantly on a level with the heels, whatever may have been the form of the shoe, or without shoes, the hoof remains circular, and the natural form and elastic structure of the frog is preserved. The inelastic quality therefore of the frog, so far from taking place in consequence of the pressure of the ground, proceeds, he says, wholly from contraction, and contraction from the want of perpendicular pressure. And that where the frog constantly meets the ground in the stable, the heels are open, and the frog elastic, expanded, and healthy; but where the cavity of the horny frog is contracted, the sensible frog is violently squeezed, and becomes hot and inflamed; and from this heat the horn becomes dry and inelastic.

He observes, in addition, that those who from false kindness raise the frog from the ground, to prevent pressure, will probably be surprised at the assertion, that the sensible frog suffers most pain and most pressure when most raised from the ground. It is, nevertheless, literally true; for, in proportion as the frog is free from perpendicular pressure, the

heels of the hoof contract; and, as the hoof contracts, the frog also becomes contracted; and, in proportion to the degree of contraction, the sides of the sensible frog, without any respite, must receive lateral pressure from the sides of the horny frog. Perpendicular pressure is natural both to the horny and sensible frogs, and the ascent of those organs prevents concussion, and preserves them in health. But nature has made no provision for permanent unnatural pressure, produced by a contraction of the cavity of the horny frog; and it has certainly, he thinks, not been considered that the frog suffers the greatest violence and more pressure when raised from, that when in contact with, the ground. Therefore, where the frog is in a morbid state, and unnaturally deprived of perpendicular pressure, it is seldom safe to lower the heels at once, so as to make the frog on a level with the shoe; and, in many cases, it is not possible with any shoes, or even without shoes, to give the frog pressure on smooth surfaces; much less is it practicable for the frog to rest on the ground when shod with common thick-heeled shoes. In the stable, therefore, while at rest, the frog is generally raised above the shoe; and, as pressure is essential to its health, particularly when the hoof is exposed to heat, it has appeared to him of great importance, in all cases where the heels of the shoe and the frog cannot with safety be made on the same level, to apply an artificial frog, to fit and give any degree of pressure, in the stable, to the natural frog, with any shoes. While the horse is in motion, and the hoof exposed to unequal surfaces, this artificial frog should, he says, be removed, as the natural frog. out of the stable, will receive frequent pressure with any shoes; but that period is of short duration, when compared to the length of time the horse remains at rest, and the frog raised from the ground. Artificial pressure he conceives to be most particularly wanted when the heat of the stable operates powerfully to contract the hoof. In all cases, therefore, where the pavement of the stable does not touch the natural frog, an artificial frog is necessary to resist contraction of the hoof, thrushes, and canker. Sand-cracks, also, very generally arise from a contracted hoof, and may be prevented by the artificial frog. But if the frog does not absolutely rest on the pavement, whatever shoes are employed, the hoof in the stable will be as much disposed to contract, as if the frog was raised any greater distance. He wishes this fact to be well considered; for it has been supposed that shoes with a flat seat, without pressure to the frog, will prevent contraction. But he is fully convinced that neither thick nor thin-heeled shoes, where the frog is raised above pressure, and exposed to the heat of the stable, can prevent contraction, or its effects; and where the frog receives that pressure, the heels cannot contract even with the most common shoes. For very obvious mechanical reasons, a wedge in the centre of the heels, aided by the pressure from below, must, he thinks, be best calculated to preserve them expanded, or, when the heels are contracted, to force them open. The heat of the stable in all cases tends to contraction of the hoof: but with common shoes there is no pressure on the wedge, or other cause to counteract that tendency. The artificial frog, which is intended to cover and give any degree of pressure to the natural frog only, is made of iron. In order to fit the natural frog, it is requisite to ascertain its width, the length of the foot, and the distance between the lower surface of the shoe and the frog. But if the artificial frog be too long, the toe, which is flat and thin, may be shortened; and if the heels of the shoe are higher than the artificial frog, nothing more is requisite than to introduce a quantity of tow between the natural and artificial frog, so as to raise it equal or above the level of the shoe. He has ascertained by experience, that no inconvenience takes place by raising the artificial frog even one-quarter of an inch above the shoe; but, in ordinary cases, it should not project more than one-sixth of an inch above the surface of the shoe. It may, however, be imagined, that so much perpendicular pressure to the frog would retard rather than increase its growth. But the very reverse is, he says, the fact: for as the frog, when long elevated above the ground, is very generally contracted, this unnatural lateral pressure excites inflammation of the sensible frog, and deprives in a great degree the blood-vessels of the power of secreting horn. When the horny frog is exposed to perpendicular pressure, it gives health, and not disease, to the sensible frog. The blood-vessels secrete their due proportion of elastic horn, and then the cavity of the frog is preserved, expanded, and fully equal to contain the sensible frog, without the smallest degree of lateral pressure. It therefore follows, he says, that perpendicular pressure increases the bulk of the frog; while its absence from the ground produces contraction, and lessens its growth or production.

The toe of the artificial frog should, he says, be inserted under the toe of the shoe. This effectually fixes the frog forwards; and, to prevent backward or lateral motion, an irregular groove is made in the iron frog, to receive a corresponding piece of steel, placed under the heels of the shoe. In general it is necessary to fix the frog more firmly; and, for that purpose, a hole is necessary, made in the heel of the artificial frog, to receive a strap, and to buckle at the outside quarter below the coronet. And that the artificial frog may give pressure in all cases with shoes thickened, or turned up for hunting or frost, a variety of frogs are made, to be adapted to particular feet and particular shoes. In cases of *thrushes* and *canker* of the frog, where no remedies without pressure are likely to be serviceable, an astringent thrush powder may, he says, be applied between the natural and artificial frog. And in contracted hoofs, where it may not be advisable to lower the heels equal with the horny frog, the artificial frog is essentially necessary.—But indeed in every horse where the shoe and frog on a smooth surface are not on the same level, whatever shoes may be used, the iron frog in the stable should be applied; and, in order to fix it with facility, the spring should first be laced under the shoe, and brought backward to the heels of the hoof.

The toe of the iron frog should then be inserted under the centre of the spring, and pushed as far as the toe of the shoe, while the other hand confines the spring until the centre of it meets the centre of the groove. The strap may then be buckled. And to dislodge the spring and iron frog, after the strap is unbuckled, nothing more is requisite than a small horse-picker, introduced into a hole at the bottom of the groove of the iron frog; and the spring being raised above the groove, and carried gently forward, the frog may be withdrawn from under the shoe without the smallest difficulty. In short, he concludes, that, in all cases where the frog and the heels of the shoe are placed on the same level, the patent frog is unnecessary. But that where the frog is small, or the pastern joint long, or the action of the animal high, or the heels low, so as to render the application of thin-heeled shoes improper, or when the frog from any cause is raised above the ground in the stable, *an artificial frog is useful* in all such cases, and necessary to resist contraction of the hoof. See *Shoeing of Horses*.—Frogs of this kind may be had at the Veterinary College, and at the different forges in London.

FROST, the ultimate effect of cold, or the act of congelation. This operation of cold is found to break down and fertilise land; therefore where the soil is harsh, stiff, or of an obstinate clayey nature, it should be turned up in ridges in the autumn or at the beginning of winter, which tends greatly to separate its particles, and render it more fine and mellow.

Hard winters seldom injure corn in any respect; especially where the land has been thoroughly drained, and is covered much with snow. However, it not only kills great numbers of vermin and insects, but, by leaving the earth in a loose powdery state, fits it for the roots to extend themselves in, as the warmth of spring approaches, and thereby enables them to produce strong plants; whereas frequent rains in winter, without frost, sodden the earth, so that it afterwards produces little or nothing but blades, which are apt soon to be destroyed by the hoar frosts of the spring, by insects, and by weeds; or which yield at most straw without much grain.

The great danger from frost is, where the earth is wet, and not covered with snow. For example, if a strong frost returns after a sudden thaw, the fibres of the roots are broken by the expansion of the surrounding water when frozen, and the too great abundance of moisture in the plants themselves when frozen, often tears their fibres to pieces by the same expansion.

It is well observed by Mr. Marshall, in his Minutes of Agriculture for 1785, that the barley had not ripened, perceptibly, for some weeks before the sharp frosts; since which it has ripened daily. There are, says he, twice the number of ripe ears, now, there were a week ago: they are not only changed as to colour, but the corn is obviously plumper. Before the frosts, the heads seemed slender and puny; so much so, that he had consigned the whole to the miller: now he begins to hope that some of it may, this year of scarcity, be fit for the maltster. And it was a general observation, in this country, in the year 1782 (a wet backward summer), that the late ripe crops did not ripen until frost came: even wheat was cut in December. How, says he, is this to be explained? Frost, we scarcely can doubt, compresses the sap-vessels of vegetables, and probably forces the sap out of them back to the earth, it is generally supposed; but perhaps the natural receptacles of the plants are first supplied.

And it is observable, that fruits ripen, leaves fall, lattermath shrinks, by frost.

It has been remarked by Dr. Darwin, that the ripening of fruit and seed is often delayed from the want of a due evaporation of their perspirable matter, and that of solar light in cloudy weather; hence, in the northern parts of the island, the oats are found to seldom ripen till the frost commences, with the dry season that attends it.

FROWAR, the name of an edge tool used in cleaving laths.

FRUNDELE, a dry measure of two pecks, or half a bushel.

FRUSH, in *farriery*, a disease in horses, sometimes termed running frush. See *Thrush*.

Frush *of a Horse*, in *farriery*, the horny substance contained in the middle of the foot. See *Frog*.

FUDDER, a term that properly relates to lead, and signifies a certain weight, *viz*. eight pigs, or sixteen hundred weight, which is a load.

FULLERS-*Earth*, a native saponaceous earth of the clayey kind, found in many parts, and much used by fullers in cleaning and scouring their cloth. It is of a very fat nature, and capable of promoting the growth of plants in a high degree; consequently may be used with advantage, as manure, where it is found in plenty, on some of the lighter sorts of land.

Fullers-*Thistle*, a name sometimes applied to a plant used by the makers of cloth. See *Teasle*.

FUMIGATION, in *farriery*, the purifying a stable, which is a useful precaution to be taken in stables after any infectious disease. It may be effected by means of a gentle heat, such substances being employed as are suitable for the particular purpose.

It is also made use of for the destruction of insects, in which cases tobacco, or other suitable materials are employed.

FUNDAMENT, in *farriery*, the anus. Horses, and most other animals, are liable to a descent or prolapsus of the fundament, or rather of the rectum, which, according to Mr. John Lawrence, "may be occasioned by long-continued looseness or scouring," and that "horses of a lax and washy constitution are most subject to it. It is produced by long journeys, or hard labour, with insufficient nourishment. The defect is frequent with overdriven pigs, which he has often attempted to cure, with very ill success."

However, in attempting the cure, no time ought to be lost. If the gut descend to any great lengt , and be much swelled and inflamed, it should be washed with lead-water, or a weak solution of alum,

and be suspended, repeating the washing till the inflammation is abated; when, with a soft linen cloth, an attempt may be made to return the gut to its proper place.

It is afterwards advised by the same writer, to bathe the fundament with a mixture prepared in this manner:

Take of red port wine, camphorated spirits, each a quarter of a pint; extract of lead, forty drops. Mix them well together, and use them as above.

FUNGUS, in *farriery*, a spongy excrescence which arises in wounds and ulcers, commonly known by the name of *proud flesh*. It may be destroyed and removed by caustic applications, and the use of tight bandages.

FUR-*Slice*, a term used for furrow-slice, in the northern parts of the kingdom. See *Furrow-Slice*.

FURLONG, the eighth part of a mile.

FURRIERS' *Clippings*, the refuse clippings made by the furriers in large towns. They are at present bought in London at from about 12*s*. to 13*s*. per quarter, which is a ten-bushel sack crammed full, weighing about 2½ cwt. The carriage to the lands costs 3*d*. per quarter. In their application, they are sown by hand from the seed-scuttle, at about 3*d*. per quarter, on the land intended to be sown with wheat or barley, and immediately afterwards ploughed in; after which, the seed is sown and harrowed in, when such pieces of the clippings as are left above ground by the harrow, are pricked, dibbled, or shoved into the ground by the end of a stick for the purpose, to prevent their being devoured by dogs or crows, which devour them greedily. And from two or three quarters are usually sown per statute acre. These clippings answer very well on light, dry, chalky, or gravelly soils, where they are supposed to hold moisture, and help the crop greatly in dry seasons by such means, But they are supposed to have but little effect where the soils are of the wet kind.

FURROW, the trench made by the plough in breaking up, or stirring land.

Two-Furrow *Plough*, the same as double plough. See *Plough*.

Furrow-*Roller*, a particular sort of tool of the roller kind. See *Roller*.

Furrow-*Slice*, the narrow slice or slip of earth turned up by the plough. By the Scotch writers on husbandry, it is mostly termed *fur-slice*.

Water-Furrow, that sort of deep open furrow which is made by the plough in tillage-lands, for the purpose of drawing off and draining them, in order to the healthy growth of the crops. Furrows of this kind should always be drawn in such directions as will the most readily take off the water, even across the ridges when necessary in this view, and be kept perfectly free and open by means of the spade, during the winter months, especially on the wheat-grounds. The making of these furrow-drains should be performed immediately after the ploughing and sowing have been finished, and is particularly necessary on all the more stiff and retentive kinds of soil.

FURROWING *Plough*, that sort of tool of the plough kind which is made use of to open furrows for keeping off the wetness from lands. See *Plough*.

FURZE, a sort of low shrubby plant, of a very hardy nature, and which is armed with prickles. By some botanical writers, it is known under the name of *genista spinosa*, and by others under that of *ulex europæus*, and provincially it is often termed *whin* or *gorse*. It will grow well on most kinds of poor dry soils, and it propagates so rapidly, by the seeds, that, where once established in a spot of ground, it soon over-spreads the whole place; for, as the seeds ripen, their pods are opened by the warmth of the sun, and they are thrown out to a considerable distance all around, where they vegetate, and soon fill the ground with young plants.

This plant may in some situations, and under particular circumstances, be cultivated to advantage for the feeding of horses and store-cattle, on light, poor, sandy, dry soils, which cannot be employed in the growth of grain, or crops of green vegetables. This method of making use of furze has prevailed for a considerable length of time, both on the continent and in some parts of this kingdom.

When furze is raised on purpose for the food of cattle, and especially on soils like the abovementioned, their seeds should be sown in February, March, or April, and the ground be prepared as for barley. Six pounds of seed is sufficient for an acre of land; being but lightly covered over. The young plants must be preserved from cattle during the first year, and they will be fit to mow or cut in the next. The following methods of cultivating this plant, with the view of converting it to the feeding of animals, have been found by Dr. Anderson to be the most successful on the better kinds of land. A field of a good, dry, loamy land, being well prepared, he sowed, along with a crop of barley, the seeds of the whin in the same way as clover is usually sown, allowing at the rate of from fifteen to thirty pounds of seed to the acre. The seeds, if harrowed in, and rolled with the barley, quickly spring up and advance under the shelter of the barley, during the summer, and keep alive during the winter. Next season, if the field has not a great tendency to run to grass, so as to choke them, they advance rapidly after Midsummer, so as to produce a pretty full crop before winter. This you may begin to cut with the scythe immediately after your clover fails, and continue to cut it as it is wanted during the whole of the winter; but it is supposed, he says, that after the month of February the taste of this plant alters, as it is in general believed that after that time horses and cattle are no longer fond of it. He however observes, that never having had a sufficiency of whins to serve longer than till towards the middle of February, or beginning of March, he cannot assert the fact from his own experience. He has frequently seen horses beating the whins with their hoofs, so as to bruise the prickles, and then eat them, even in the months of April and May; and he says, that sheep which have been used to this food certainly pick off the blossoms and the young pods at that

season, and probably the prickles also; so that it is possible the opinion may only be a vulgar error.

This is, he thinks, the best way of rearing whins as a crop for a winter-food for cattle or horses. But for sheep, who take to this food very kindly when they have once been accustomed to it, less nicety is required; for, if the seeds be simply sown broadcast, very thin (about a pound of seed per acre) upon the poorest soils, after they come up the sheep of themselves will crop the plants, and soon bring them into round close bushes, as this animal nibbles off the prickles one by one very quickly, so as not to be hurt by them. Sheep, however, who have not been used to this mode of browsing, do not know how to proceed, and often will not taste them; but a few that have been used to the food will, he observes, soon teach all the rest how to use it.

And another very œconomical way of rearing whins, but which he has seen practised, rather than experienced himself, is this: Let a farm be inclosed by means of a ditch all round, with a bank thrown up on one side; and if stones can be had, let the face of that bank be lined with the stones, from bottom to near the top; this lining to slope backwards with an angle of about sixty or seventy degrees from the horizon. Any kind of stones, even round ones gathered from the land, will answer the purpose very well: upon the top of the bank sow whin-seeds pretty thick, and throw a few of them along the face of the bank. Young plants will quickly appear. Let them grow for two years, and then cut them down by means of a hedge-bill, stripping down by the face of the bank. This mode of cutting is very easy; and as the seeds soon insinuate themselves among the crannies of the stones, the whole face of the bank becomes a close hedge, whose shoots spring up with great luxuriance. If another ditch be made on the other side of the bank, and if this be managed in the same way, and the hedge cut down only once every second year (and in this way it affords very good food for beasts), the inside and outside being cut down alternately, the fence will at all times continue good, as the hedge at the top will at all times be complete. This mode of rearing whins is, he remarks, both convenient and œconomical. But where stones cannot be obtained for making the facing, the bank very soon moulders down, and becomes unfit for the purposes of a fence.

Circumstances have, he says, prevented him from ascertaining what is the weight of the crop that may be thus attained; but he thinks he may safely venture to say that it is at least equal to that of a crop of green clover; and if it be considered that this affords a green succulent food during winter, on which cattle can be fatted as well as on cut grass in summer, it will, he thinks, be admitted, that it must be accounted even a more valuable crop than clover. After being cut, he also remarks, that it springs up the following season with greater vigour than before; and, in this situation, acquires a degree of health and succulence very different from what it is ever observed to possess in its natural state. He has seen shoots of one season near four feet in length. The prickles too are so soft, and the stems so tender, that very little bruising is necessary; indeed horses, that have been accustomed to this food, would eat it without any bruising at all: but cattle, whose mouths seem to be more tender, always require it to be well bruised. How long crops of this sort may continue to be annually cut over, without wearing out, he cannot say; but he believes a long while, in favourable circumstances: however, one thing is necessary to attend to in order to guard against its being destroyed. As, during the beginning of the season, nature seems to be solely employed about the great work of fructification only, and it is not till near Midsummer that the whin begins to push forth its wood-bearing branches, which advance with great luxuriance only during the latter part of the season, it may happen that, if care be not taken to have the grass that springs up on the field before the whin begins to send out its shoots eaten close down, that grass will acquire such a luxuriance before the young branches of the whin begin to advance, as to overtop them, and choke them entirely. Whoever therefore has a field under this particular crop must, he says, be careful to advert to this circumstance, or if the field be in good heart, he will infallibly lose it. The field therefore should be kept, as a pasture, bare as possible during the beginning of the season, and the cattle should only be taken from it when the shoots of the whin are discovered to begin to advance with vigour. Under this management, he presumes, it may be kept for many years, and yield full crops: but unless the mowers be particularly attentive, at the beginning, to cut it as low as possible, it will very soon become impossible to cut the field with a scythe, as the stumps will soon acquire so much strength as to break the scythe when it happens to touch them.

It is remarked in a paper in the ninth volume of the Annals of Agriculture, that by cutting a part of ground down in this way, every third year, very large crops may be obtained. It is also probable that the plants may continue longer. October is the proper time to begin mowing or cutting them. They continue to shoot till Christmas, and are fit for use until March. Horses are said to eat them as readily as they do hay, after they have been chopped with a cleaver, and bruised or pounded, by a mill, or otherwise, so as to take off their sharp points; and it is said that an acre of ground will produce ten or fifteen tons of this fodder, and that it will go as far as an equal quantity of hay. Some mix the bruised furze with chopped straw; an hundred of straw to a ton of furze; but in whichever way employed, only the growth of the year should be cut for the cattle.

Dr. Anderson further remarks, that he knows few plants that deserve the attention of the farmer more than the whin. Horses are peculiarly fond of it, so much so that some persons think they may be made to perform hard work upon it, without any feeding of grain; but he thinks it tends more to fatten a horse than to fit him for hard labour, and

that therefore some grain should be given with it where the work is severe. Cattle, he says, eat it perfectly well when thoroughly bruised, and grow fat upon it as upon turnips; but unless it be very well bruised for them, they will not eat it freely, and the farmer will be disappointed in his expectations. Cows that are fed upon it yield nearly as much milk as while upon grass, which is free from any bad taste; and the best winter-made butter he ever saw was obtained from the milk of a cow that was fed upon this plant. This food should be made use of soon after being prepared. Two bushels, with a proper allowance of hay, have been found to be sufficient for a day for three horses performing the same labour as with corn. It also seemed useful to horses labouring under broken-wind and grease. Poor hungry gravelly soils, which would not have let for five shillings an acre, have also been rendered worth twenty shillings, by sowing them with furze-seed, in places where fuel has been scarce; this being frequently used for heating ovens, burning lime and bricks, and also for drying malt; but it is not worth cultivating in countries where fuel of any kind is cheap, or upon such lands as will produce good grass, corn, or other crops employed as the food of animals.

It is stated by Mr. Young, in his Calendar, that in Surry, Doctor Taylor "had a poor field of six acres, worth 7*s.* per acre, sown with furze, and thus converted to be the most profitable of the farm: the land being cleared from couch, in April 1782; mown in 1784, to thicken it; and cut for the first crop in 1786, and since regularly every two years, three acres per annum. Last year's cut of three acres produced 7700 faggots, and sold at 3*l.* 3*s.* per 1000, on the spot; this 24*l.* 5*s.* 6*d.*; cutting and binding 1*s.* 6*d.* per hundred, or 5*l.* 15*s.* 6*d.*; clear, 18*l.* 10*s.* Suppose tithe, rates, and fences, to equal 5*s.*, rent 7*s.*, in all 12*s.*; or, for three acres, 1*l.* 16*s.*; that, further charge deducted, net 16*l.* 14*s.*; or, per acre, 5*l.* 11*s.* 4*d.*; and, per acre per annum, 2*l.* 15*s.* 8*d.* which is, he thinks, a greater net profit than any man receives from wheat upon such land." And, he adds, that the "Doctor thinks that the product rather increases than diminishes." In respect to "the time of cutting, would recommend dry weather in February, or the beginning of March, when severe frosts are over," and there is no danger of the plants being injured in that way.

We have the following description, by the first-mentioned author, of a mill constructed for the purpose of bruising furze for the above purposes, and also of the methods of employing it, in the fifth volume of the Memoirs of the Bath Society. It consists of a large circular stone set on its edge (the weightier and bigger the better), with a wooden axis passing through its centre. One end of this axis is fixed upon a pivot placed in the centre of a circular area, and to the other end of it is fixed a yoke, to which the horse that is to move it is attached. The stone being placed on its edge, when the horse moves it revolves round its axis in a circular groove, or stone trough (this trough should be made of hewn stone), exactly in the same manner as a sugar-baker's or a tanner's mill. The whins being placed in this trough are bruised by the weight of the stone as it passes over them; and being raised up by a three-pronged fork by the attendant, after they have been well flatted down, they rise on a sort of matted cake, which, being set in some measure upon its edge, is again smashed down by the wheel as it revolves. In this way the operation is continued, by successively presenting new surfaces to the action of the wheel, till the whole is reduced to a soft pulpy mass, that can easily be eaten by the animals to which it is to be presented. During the continuance of this process, it is necessary, he observes, to pour plenty of water upon the whins, at different times, without the help of which they can scarcely be reduced to a pulp soft enough. On this account it will be proper to make choice of a place for the machine, where plenty of water can be obtained with little labour. It follows also, that, as rain can never be prejudicial to this operation, it may be placed in the open air with propriety.

And as the operation is greatly facilitated by a judicious way of raising or turning the whins, during the performance of the work, which a little experience will enable any attentive person to attain, but which cannot be taught by words only; he would advise any person who should think of erecting an apparatus of this sort, to put one of his most sagacious servants to conduct this operation at the beginning, as such a person will more quickly discover the circumstances that facilitate the process, than one of a slower comprehension. After he has become expert at the business, he will be able to instruct an inferior person, who may then be employed for the purpose. But in whatever way it shall be conducted, the person who begins this manufacture must lay his account with performing very little work for some time at the first, in comparison of what he will be able afterwards to execute with ease and facility.

Where the whins that are to be employed for this purpose grow naturally in the soil in irregular bushes, it is, he says, a troublesome work to cut and gather them. To understand the proper mode of managing this business in all its departments, it is, he thinks, necessary to advert to several particulars in the natural œconomy of this singular plant. Instead of leaves, the whin is furnished with an innumerable quantity of prickles. These spring out from every part of the young stem, and are, at the first, like the stem itself to which they adhere, succulent, soft, and inoffensive; but, like the stems also, they become gradually harder as the season advances, and seem, indeed, to a casual observer, to form a part of that stem, though they are as different from it as the leaves of other trees are from the branches which produce them. These prickles do not, he observes, like the leaves of most deciduous trees, fall off at the approach of winter; but, like evergreens, they remain upon the branches all winter, and retain du-

ring that time their full succulence and verdure. Early in the spring, innumerable blossoms spring out around these prickles, adhering to them, and not to the stem. The blossoms are succeeded by pods containing the seeds, which gradually ripen; a little after Midsummer the seeds harden, and the pods slowly become dry and wither, the prickles to which they adhere becoming dry and withered at the same time, and gradually loosen from the stalk, which still continues fresh, though it has now attained a woody consistence. These prickles, having now performed all the functions that nature had designed them, fall off in part, at first from the stalk, and in part adhere to it for some time, till they are gradually shaken off by the agitation of the wind, or other causes. Hence it happens that it is only the surface or top twigs of a whin-bush that are green, soft, and succulent, the stems below being dry and woody, and frequently covered with dry prickles, that are not only not useful as food for cattle, but rather hurtful to them, on account of the hardness of their consistence, and sharpness of the prickles. In gathering whins, therefore, for food for cattle, it is only the tender top shoots that are wanted; and the easiest method of gathering them that our practice has yet discovered, is to take a forked stick in the left hand (the readiest thing is the branch of a tree of a proper size), and a sickle in the right hand (both hands, but more especially the right, should be armed with strong gloves); then thrusting the sickle among the young shoots, and pulling it backward, the forked stick when opposed to them keeps the branches steady enough to produce a resistance sufficient to make the sickle cut them; and as the tops of the whins are intermixed with each other, they stick to the prongs of the fork, which, after it is as full as it can hold, is taken to a side, and cleared by pressing the whins to the ground, and pulling the fork backwards. These little heaps are afterwards forked to a cart, and pressed down by a man walking upon them, having his legs covered with large strong boots made on purpose, and thus are carried home. Where the whins have grown upon a good soil, and have made very vigorous shoots, they may be thus reaped pretty expeditiously; but if the soil has been poor, and the shoots short, the expense of this operation is very considerable; and as these short whins are, in other respects, of a very inferior quality to the others as food for beasts, it is only at times when fodder is scarce and dear that they can be œconomically applied to this use. But by being cultivated in the manner that has been described above, the labour may not only be much lessened, but the advantages of this winter food be more fully obtained.

Formerly the common furze used to be much sown for hedges about fields; and where the soil was light, the plants soon became strong enough for a fence against cattle: but as these hedges grow naked at the bottom in a short time, and the plants frequently fail, so as to leave considerable gaps, and are liable to spread their seeds over the neighbouring fields, the practice has of late been greatly disused. When this is attempted, the species commonly called French furze is the best for the purpose, because it thickens more near the ground, and grows to a greater height. This kind begins to blow in the middle of January, and continues in blossom all the summer; while the English furze does not bloom till towards the end of the spring, and finishes its blossoming at the same time as the other.

Furze is frequently necessary to be extirpated, in bringing waste or other kinds of land into a state of cultivation, in which cases, it may be the most effectually performed by grubbing the whins up after they have been burnt or cut over with a whin-axe. Mr. Nicol found the ashes admirable as a manure for the growth of timber, and recommends it as highly useful in composts.

Furze *Grounds*, such portions of land as are destined for or covered with furze. Mr. Marshall, in the first volume of his Rural Economy of Yorkshire, gives it as the opinion of a person who has paid close attention to the subject, that old furze-grounds, off which fuel has been repeatedly carried, and which are much depauperated, may in general be readily improved in the following way: First, grub up the furze; then sow grass-seeds, on the grubbed surface, without ploughing; and let the land remain in this state until it has acquired a degree of firmness, the smaller roots left in it being decayed, and the surface become covered. Then sod-burn, lime, &c. and break up the soil for a course of arable crops; closing with cultivated grass. If the furze begin again to grow and be troublesome, repeat the process of paring and burning as before.

Furze *Mill*, a mill constructed for the purpose of bruising furze for feeding animals. A contrivance of this sort has been described under the article furze.

FUZEE, in *farriery*, a name given to two considerable splints joining from above downwards. It mostly rises to the knee, and lames the horse. They differ from screws or thorough-splints in this, that the latter are placed on the two opposite sides of the leg; and they were reckoned much more dangerous than a simple splint. See *Splint*.

FUZZEN, a provincial term used sometimes to signify the natural juice or nourishment of a substance, or the strength of it. It is sometimes written *Fuzen*.

G.

GAALFAT, provincially the vat in which wort is fermented. See *Guilefat*.

GAD, a term applied to a rod with a leathern thong fastened to it, used formerly in driving ox-teams. It was sometimes furnished with a prick in the contrary end.

GAIT, in *horsemanship*, a term used for the manner of going or pace of a horse.

GAIT, provincially a door. A bye-way across a common field. It also signifies the gowing of a cow in a summer pasture. Likewise a single sheaf of corn bound near the top, and set upon its butend. See *Harvesting of Grain*.

GALE, a term applied to a castrated bull.

Navel-GALL, in *farriery*, a disease in horses. See *Navel-Gall*.

Wind-GALL, in *farriery*, a frequent disease in the same animal. See *Wind-Gall*.

GALLED, in *farriery*, a term signifying an abrasion, or rubbing off, of the skin by the saddle, harness, &c. See *Galling of the Back*.

GALLED, scattered over with thin places in crops.

GALLERY, a term somtetimes applied to a kind of covered walk in a garden, or pleasure-ground, formed by means of horn-beams, limes, and other similar trees.

GALLINACEOUS *Birds*, such birds as are of the order *gallinæ*, or the hen kind.

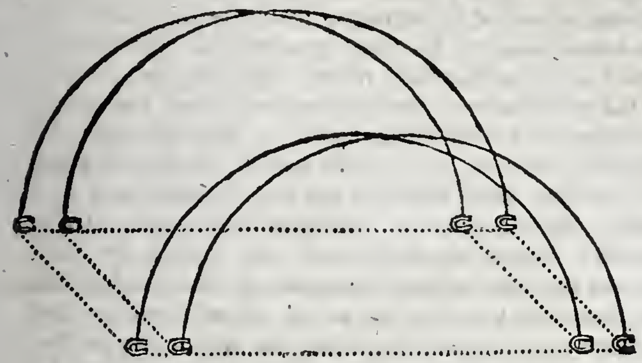
GALLING *of the Back*, in *farriery*, a disease occasioned by heat, and the chafing or pinching of the saddle, in the back of a horse. In order to prevent accidents of this kind, it is necessary that the saddle be made to fit with exactness, and be prevented from slipping from its situation; and also to have the horse's back frequently rubbed with a dry cloth, to prevent the accumulation of perspiration and moisture. But if, notwithstanding these precautions, an injury of this sort has taken place, the best remedy is, probably, that of bathing the swelled part with a cold saturnine wash, or vinegar and brandy, for a few days, in order to remove the inflammation. Some, however, think that the best method of prevention is to take a hare's skin, well furnished with hare, and fit it neatly beneath the pannel of the saddle, so that the hairy side may be next the horse: this does not harden by sweat, but keeps the horse from galling. It is a method that should never be omitted with horses that are newly cured of it, as it will prevent the same happening again. In long journies, where horses are subject to gall, it is always proper to take off the saddle immediately when they come in, and examine whether the back be at all pressed, or pinched in any part. And it will be well to re-examine it after an hour or two, to see what has happened; for often the part hurt will not shew it at first, but will swell very violently afterwards. In this case, where the skin is not fretted, but a swelling comes on, it may be rubbed with the above applications, laying on rags soaked in it. If the skin be broken, a plaister of any mild salve may be applied.

GALLON, a measure of capacity both for dry and liquid matters, containing four quarts; but these quarts, and consequently the gallon itself, are different, according to the quality of the thing measured: for instance, the wine gallon contains 231 cubic inches, and holds eight pounds avoirdupoise of pure water: the beer and ale gallon contains 282 solid inches, and holds ten pounds three ounces and a quarter avoirdupoise of water; and the gallon for corn, meal, &c. 272 cubic inches, and holds nine pounds thirteen ounces of pure water.

GALLOP, in *horsemanship*, a well-known pace to which horses are trained, and of which many kinds are enumerated, but two only are worthy of regard, namely, the hand gallop and full gallop. And these distinctions are founded on the different degrees of velocity in which the animal is impelled, rather than on any peculiarity in the pace istelf. In the galloping, the horse leads with one fore-leg somewhat advanced, but not so much beyond the other as happens in the canter; and, when he is urged to his utmost speed, his legs are almost equally placed. The fleetest horses, when galloping, carry their bodies perfectly in a horizontal posture, and the fewer curves or successive arches are described, the more rapid of course is their progress.

According to Mr. Lawrence, in every instance of progression, bodies are retarded in proportion as they depart from a right line, whether this be horizontally or perpendicularly. Of course he thinks, that "none but horses of great powers are able to gallop in this form; for, to supply the want of undulation in the body, they must bend their limbs in a greater degree; and hence the necessity of their standing perfectly on the centre of gravity. The action of the gallop being more extended than the canter, it is necessary that the horse should have his head more at liberty; for a horse cannot gallop out with his head reined up. Thus, in the swift gallop, he carries his head and neck nearly horizontal." And, he supposes, the practice of accustoming horses to pull against

their riders is highly injurious, by deadening their mouths, and rendering them more apt to fall by too much power being directed forwards. The actions of the gallop are more fully explained in the following figure:



The gallop, according to Mr. St. Bell consists in "a repetition of bounds or leaps, more or less high, and more or less extended, in proportion to the strength and lightness of the animal." And, that the "common gallop contains *three times*. If the horse, for example, begins his gallop on the right, the left hind-foot beats the *first* time; the right hind-foot and left fore-foot beat the *second* time together: and the right fore-foot beats the *third*." But that "in the gallop of *four times*, the feet strike the ground in the same order as in walking. Supposing the horse galloping on the right, the left hind-foot beats the first time, the right hind-foot beats the second, the left fore-foot beats the third, and the right fore-foot beats the fourth. This gallop is regular, but confined, and but little adapted for speed." Also, that "the gallop at two times is faster than at three or at four; the legs follow in the same order as in the trot, so that the two sounds are given by the left hind-foot and right fore-foot striking the ground together, and by the right hind-foot and left fore-foot also striking the ground together."

In the training a horse to gallop, he "may lead with which fore-leg he pleases; but the most usual way is that with the right: however, whichsoever it be, the hind-leg of the same side must follow next; otherwise the legs are said to be disunited, and the gallop to be false. To remedy this irregularity, the rider must stay the horse a little on the hand, and help him with the spur a little on the contrary side to that on which he is disunited. As for example, if he be *disunited* on the right side, he should help him with the left spur, by staying him as before on the hand a little, and also helping him at the same time with the calves of the legs." But in going "in a circle, the horse is confined always to lead with his fore-leg within the turn, otherwise he is said to gallop *false*; but here too the hind-leg of the same side must follow. In trying the gallop, the rider should observe, if the horse perform it equally, and should push him on somewhat hard, that he may know by his stop, whether he has strength and vigour, and also, if he be sensible to the prick of the spur. Much care should be taken in training horses to this pace.

GALLOWAY, the usual name of a poney or under-sized saddle-horse.

Galloway-*Dyke*, a peculiar sort of earth and stone fence. See *Fence*.

GALLOWS, a name given to pieces of wood nailed together in a transverse manner. They are useful for various purposes.

Gallows *of a Plough*, a part of the plough-head, called so by farmers, from its resemblance to the common gallows, as consisting of three pieces of timber, of which one is placed transversely over the heads of the other two. See *Plough*.

GALLS, a term signifying vacant or bare places in a crop.

GAME, a term generally applied to such birds or animals as are preserved in order to be taken at particular seasons by means of shooting, hunting, netting, &c. by persons properly qualified after taking out a licence for the purpose; and are partridges, pheasants, hares, &c. &c.

Game-*Laws*, such laws as respect the killing of game.

It is observed by the author of "the present State of Husbandry in Great-Britain," in speaking of the obstacles to the improvement of agriculture, that the game-laws operate powerfully against the farmer; they give, he thinks, to a few opulent individuals a power of doing mischief, which the legislators of no country have a right to dispense, and which in this is found to be a real grievance. He asks, what right certain classes of persons have to gallop over this field of new-sown wheat, or that field of cole, or of turnips, the property of another? The answer is, they are warranted by law. This may be true: but, says he, will any person pretend to deny that such laws are made for the destruction, not the protection, of private property? The practice of hunting is, he contends, very injurious to farmers; the winter corn in wet situations, and turnips in all, are often much damaged by the horses; the fences are also broken, and gates left open; whereby different species of stock get mixed together, and in numerous instances commit trespasses. It is also, he asserts, well known, that sportsmen pay no regard to fences, or to crops of any kind; and that if a farmer, who suffers material injury from the commission of such depredations, dares to complain, especially if he is a tenant at will, his removal is the consequence; at any rate, he is branded with the character of a turbulent fellow. And why? Because, says he, while he sees a number of men on horseback doing an act of manifest injustice, committing devastation on his property, which in this case the law of the land does not protect, he dares to remonstrate against proceedings which ought not to be tolerated in any country where it is the boast of the inhabitants that laws are enacted sufficient for the protection of individual property. It would therefore be prudent, he conceives, in the executive government, to make such alterations as would render the game-laws less exceptionable; that would prevent the possibility of private property being injured under the sanction of

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law. For it must, he maintains, be universally acknowledged, that any law that gives to A the power of demolishing the property of B, is unjust in its principle, and oppressive as well as grievous in its consequences: and that this is the case, in regard to the game-laws, is a fact that there is scarcely a farmer in the island who cannot, from woeful experience, attest.

The following are abstracts of the different acts of parliament relating to game, by which the sportsman may know the respective times of sporting for each kind, and also the penalties and punishments of infringing or breaking the acts. Agreeably to the act of 24 Geo. III. certificates required before the first of October 1784, shall bear date on the day of the month on which the same shall be issued, and shall remain in force until the first day of July next following. No certificate shall issue between the first day of October 1784, and the first day of March 1785; and every certificate which shall issue after the said first day of March 1785, shall be issued between the first day of March and the first day of July in each year, and shall bear date on the day of the month on which the same shall be issued, and shall be in force for twelve calendar months, commencing from the date; and any clerk of the peace, his deputy, steward or clerk, issuing certificates, otherwise than directed, to forfeit 50*l.* 24 Geo. III. ses. 2. c. 43. s. 5. But certificates may issue to any person beyond the seas, who hath, or shall have, in any year, first arrived in England, any time after the first day of July in such year; but in every such case the cause shall be specified, either in the body or at the foot of such certificate; to bear date on the day it is issued, being stamped with double duties, and to be in force till the first day of July next following the date thereof, 24 Geo. III. ses. 2. c. 43. s. 6. Every qualified person, after the said first day of October 1784, shooting at, killing, taking, or shooting any pheasant, partridge, heath-fowl, or black game, or any grouse, or red game, or any other game, or killing, taking, or destroying any hare, with any greyhound, hound, pointer, spaniel, setting dog, or other dog, without having obtained such certificate, shall forfeit the sum of 50*l.* 24 Geo. III. ses. 2. c. 34. s. 7. Clerk of peace, &c. shall, on or before November 1, 1784, and in every subsequent year, on or before August 12, in each year, make out and transmit to the Stamp-office, London, alphabetical lists of the certificates so granted by them, distinguishing the duties paid on each respective certificate so issued; and on delivery thereof, the receiver-general of the stamp duties shall pay to the clerk of peace, &c. for the same, one farthing a name; and in case of neglect or refusal, or not inserting a full, true, and perfect account, he shall forfeit 20*l.* 24 Geo. III. ses. 2. c. 43. s. 9. Lists may be inspected at Stamp-office for 1s. each search, 24 Geo. III. ses. 2. c. 43. s. 10. If any qualified person, or person having a deputation, shall be found in pursuit of game, with gun, dog, or net, or other engine for the destruction of game, or taking or killing thereof, and shall be required to show his certificate, by the lord or lady of the manor, or proprietor of the land whereon such person shall be using such gun, &c. or by any duly appointed game-keeper, or by any qualified and certified person; or by any officer of the stamps, properly authorised by the commissioner, he shall produce his certificate; and if such person shall refuse, upon the production of the certificate of the person requiring the same, to show the certificate granted to him for the like purpose; or, in case of not having such certificate to produce, shall refuse to tell his christian and surname, and his place of residence, and name of the country where his certificate was issued, or shall give in any false or fictitious name, he shall forfeit 50*l.* 24 Geo. III. ses. 2. c. 43. s. 12. Certificates do not authorise any person to shoot at, kill, take or destroy any game, at any time that is prohibited by law, nor give any person a right to shoot at, &c. unless he be duly qualified by law, 24 Geo. III. ses. 2. c. 43. s. 13. No certificate, obtained under any deputation, shall be pleaded or given in evidence, where any person shall shoot at, &c. any game out of the manor or lands for which it was given, 24 Geo. III. ses. 2. c. 43. s. 14.

It has been given as an opinion, by lord Mansfield, that an unqualified person may however go out to beat the hedges, bushes, &c. with a qualified person, and to see the game pursued or destroyed, provided the unqualified person have no gun or other engine with him for the destruction of the game, without being subject to a penalty.

The penalties in respect to game are the following: Destroying coneys, transportation, 5 Geo. III. c. 14. Robbing warrens, felony without clergy, 9 Geo. I. s. 22. Killing them in the night, or endeavouring to kill them, fine of 10*s.* or commitment, 22 and 23 Car. II. c. 25. s. 5, 6. Unqualified persons using guns to kill them, same may be seized, 3 Jac. I. c. 13. s. 5. Stalking deer without leave, 10*l.* 19 Hen. VII. c. 11. Hunting or killing them, 10*l.* costs, and sureties for good behaviour, 5 Eliz. c. 21. Buck-stalls or engines kept by unqualified persons, may be seized, 3 Jac. I. c. 13. Selling, or buying them to sell again, 40*s.* 3 Jac. I. c. 27. Coursing or killing them without consent, 20*l.* 13 Car. II. c. 10. Hunting, taking, killing or wounding, 30*l.* or transportation, 3 Will. III. c. 10. 5 Geo. I. c. 15. 9 Geo. I. c. 22. 10 Geo. II. c. 32. Destroying pales or walls of inclosed grounds without consent, 30*l.* 5 Geo. I. c. 15. s. 6. Keeper of park killing or taking them, 50*l.* 5 Geo. I. c. 15. Robbing places where kept, felony without clergy, 9 Geo. I. c. 22.

All lords of manors, or other royalties, may appoint game-keepers, 22 and 23 Car. II. c. 25. s. 2. and empower them to kill game, 2 Burn's Just. 225. But if he disposes of game without the lord's consent, he shall be committed for three months, and kept to hard labour, 5 Anne, c. 14. s. 4. But no lord shall make above one game-keeper within one manor, with power to kill game, and his name shall be entered with clerk of peace; certificate whereof shall be granted by clerk of peace on payment of one shilling. Unqualified game-keeper killing or

selling hare, pheasant, partridge, moor, heath-game, or grouse, he shall forfeit 5*l.* by distress, or commitment for three months, for the first offence, and for every other four, 9 Anne, c. 21. s. 1. No lord of manor shall appoint unqualified game-keeper, or one who is not *bona fide* servant to such lord, or immediately employed and appointed to take and kill game for the sole use of lord; other persons under colour of authority for taking and killing game, or keeping any dogs or engines whatsoever for that purpose, shall forfeit 5*l.* In like manner, 3 Geo. I. c. 11. s. 1. Every deputation of a game-keeper to be registered with clerk of the peace, or in the sheriff or steward's court-books of the county where lands lie, and certificate annually taken out thereof, stamped with an half-guinea stamp, 24 Geo. III. ses. 2. c. 43. s. 1. and by the 31 of Geo. III. c. 21. with an additional half-guinea stamp, making in the whole one guinea. Every game-keeper, from and after the passing of this act, who shall so deliver his name and place of abode as aforesaid, and require a certificate, shall be annually entitled thereto, stamped as before directed, from clerk of peace, or his deputy, sheriff, or steward's clerk, to the effect of the form in the act set forth, 24 Geo. III. ses. 2. c. 43. s. 3. Clerk of peace, &c. after signing certificate, shall issue same stamped to person registering deputation, on requiring same, for which he may receive 1*s.* 24 Geo. III. ses. 2. c. 43, s. 4. Neglecting, or refusal of issuing certificates, incurs a forfeiture of 50*l.* 24 Geo. III. ses. 2. c. 43. s. 4. recoverable in courts of Westminster, or court of Session, of Justiciary, or Exchequer in Scotland, by action of debt or information, for the use of the plaintiff, with double costs of suit, 24 Geo. III. ses. 2. c. 43. s. 18. And moreover be liable to pay the duty on such certificate, 24 Geo. III. ses. 2. c. 43. s. 4. Clerk of peace, &c. may issue his certificate to any game-keeper first appointed in any year after first July in that year, 24 Geo. III. ses. 2. c. 43. s. 6. If any lord or lady of a manor, or proprietor of land, shall make any new appointment of a game-keeper, and shall register deputation with clerk of peace, &c. and obtain a new certificate thereon, the first shall be void; any person acting under the same, after notice, shall be liable to all the penalties of the game-laws, and those against unqualified persons, 24 Geo. III. ses. 2. c. 43. s. 11.

Every person tracing or coursing hares in the snow shall be committed for one year, 31 Eliz. c. 5. unless he pay to church-wardens, for the use of the poor, 20*s.* for every hare, or become bound by recognizances with two sureties in 20*l.* a piece, not to offend again; and every person taking or destroying hares with any sort of engine, shall forfeit, for every hare, 20*s.* in like manner, 1 Jac. I. c. 27. s. 2. Persons found using engines liable to punishment inflicted by 31 Eliz. c. 5. See above, and 22 and 23 Car. II. c. 25. s. 6. Unqualified persons keeping or using shooting dogs, or engines to kill or destroy hares, shall forfeit 5*l.* to the informer, with double costs, 2. Geo. III. c. 19. by distress, or committed for three months for the first offence, and for every other four, 5 Anne, c. 14. s. 4. Taking or killing hares in the night-time, forfeit 5*l.* 9 Anne, c. 25. s. 3. The whole to the informer, with double costs, 2 Geo. III. c. 19. as directed by 5 Anne, c. 14. 9 Anne, c. 25. s. 3. Killing or taking with gun, dog, or engine, hares in the night, between the hours of seven at night and six in the morning, from October 12 to February 12, and between the hours of nine at night and four in the morning, from February 12 to October 12, or in the day-time upon Sunday or Christmas-day, to forfeit not less than 10*l.* nor more than 20*l.* for the first offence; nor less than 20*l.* or more than 30*l.* for the second offence; and 50*l.* for the third offence; with costs and charges; and upon neglect or refusal, be committed for six or twelve calendar months, and may be publicly whipped; final appeal to quarter sessions, 13 Geo. III. c. 80. Persons armed and disguised, stealing them, felony without clergy, 9 Geo. I. c. 22. Higgler, chapman, carrier, inn-keeper, victualler, or alehouse-keeper, having in his custody, or buying, selling, or offering to sale, any hare, unless sent up by some person qualified, (or any person selling, exposing, or offering to sale, hares, 28 Geo. II. c. 22.) shall forfeit for every hare 5*l.* the whole to informer, 2 Geo. III. c. 19.

For preserving heath-cocks or polts, no person whatsoever, on any waste, shall presume to burn, between February 2 and June 24, any grig, ling, heath, furze, goss, or fern, on pain of commitment for a month or ten days, to be whipped and kept to hard labour, 4 and 5 W. and M. c. 23. s. 11. Shooting heath-cocks, grouse, or moor-game, contrary to 1 Jac. I. c. 27. s. 2. and killing any of them in the night, or using gun, dog, or engine, with such intent, contrary to 9 Anne, c. 25. and 13 Geo. III. c. 80. And carriers and others having such game in their possession, contrary to 9 Anne, c. 14. are all liable to the same penalties, and recoverable in the same manner as those offences are subjected to in regard to shooting, &c. hares.

Officers of the army, without leave of the lord of the manor, destroying coney, hare, pigeon, pheasant, or partridge, or his majesty's game, shall forfeit 5*l.* to the poor; and the commanding officer, for every offence committed by any soldier under his command, shall forfeit 20*s.* in like manner; and if, upon demand, he shall not in two days pay said penalty, he shall forfeit his commission. *Vide* the yearly Mutiny Act.

Taking partridges, by nets or other engines, upon another's freehold, without special licence of owner of same, 10*l.* half to him who shall sue, and half to owner or possessioner, 11 Hen. VII. c. 17. Shooting at, &c. partridges, with gun or bow, or taking, &c. them with dogs or nets, by 7 Jac. I. c. 11, or taking their eggs out of their nests, liable as persons shooting at, &c. hares, and also 20*s.* for every bird or egg, as is shown in preceding column concerning hares. Selling, or buying to sell again, a partridge, (except reared and brought up in houses, or from beyond sea) forfeit for every partridge 10*s.* half to him who will sue, and half to informer,

1 Jac. I. c. 27. s. 4. Taking, killing, or destroying partridges in the night, forfeits for every partridge 10*s.* half to him who will sue, and half to lord of the manor, unless he license or cause the said taking or killing, in which case this half shall go to the poor, recoverable by church-warden; and if not paid in ten days, to be imprisoned for one month; and, moreover, shall give bond to justice, with good sureties not to offend again for two years, 23 Eliz. c. 10. To kill a partridge in the night is 5*l.* penalty, 9 Anne, c. 25. s. 3. the whole whereof is given to the informer, 2 Geo. III. c. 19. and may be recovered wi hin three months, 5 Anne, c. 14. before a justice of peace, or within six months, by action in Court of Record at Westminster, 9 Anne, c. 25. with double costs, 2 Geo. III. c. 19. Keeping or using any greyhounds, setting-dogs, or any engine for destroying partridges, 5*l.* to be levied and recovered as the like penalty for killing hares, by 5 Anne, c. 4. s. 4. as before is shown. Penalties for using gun, dog, snare, net, or other engine, with intent to take or destroy partridges in the night, or on Sunday or Christmas-day, same as using them against hares, by 13 Geo. III. c. 80. as in the foregoing column. Carriers and others having partridges in their possession, liable to the same forfeitures as having hares; and the same laws against shooting them as for shooting hares.

All the laws respecting the penalties and recovery of them, for taking them by nets, snare, or other engines, without licence of the owner, by Hen. VII. c. 17. And for shooting, or destroying them with dogs or snares, &c. by 7 Jac. I. c. 11. or taking their eggs, by 1 Jac. I. c. 27. s. 2. And for selling, and buying them to sell again, by last cited act (except that the penalty for a pheasant is 20*s.*) and for destroying them in the night, excepting as aforesaid, by 23 Eliz. c. 10. 9 Anne, c. 25. s. 3. and 13 Geo. III. c. 80. And for keeping or using sporting dogs or engines for destroying them, by 5 Anne, c. 14. s. 4. Or for using gun, dog, or net, for destroying them on Sunday or Christmas-day, by 13 Geo. III. c. 80. and for carriers and others having them in their possession; are, *mutatis mutandis*, the same as those respecting partridges.

Persons prosecuted for any thing done in pursuance of this act, may plead the general issue, and give the special matter in evidence for his defence; and if, upon trial, verdict pass for defendant, or plaintiff become non-suited, defendant shall have treble costs of plaintiff, 24 Geo. III. ses. 2. c. 3. s. 24.

Qualifications for killing game (besides the late new tax) are, 1. Having a freehold estate of 100*l.* per annum, 22 and 23 Car. II. c. 25. 2. A leasehold estate, for 99 years, of 150*l.* per annum. 3. The eldest son or heir-apparent to an esquire, or person of superior degree. 4. The owner or keeper of a forest, park, chace or warren. See Bl. Com. 174, 175. Unqualified persons keeping dogs or engines to destroy the game, to forfeit 5*l.* 5 Anne c. 14. Restrictions in the laws concerning the preservation of game seem to affect all persons whomsoever, whether qualified or not, 2 Burn's Just. 219, 248. No person (other than the king's son), unless he have lands of freehold to the value of five marks a year, shall have any game of swans, on pain of forfeiting them, half to the king, and half to any person (so qualified) who shall seize the same, 22 Edw. IV. c. 6. Any gentleman or other that may dispend 40*s.* a-year freehold, may hunt and take wild-fowl with their spaniels only, without using a net or other engine, except the long-bow, 25 Hen. VIII. c. 11. From persons not having lands of 40*l.* a-year, or not worth in goods 200*l.* using gun or bow to kill deer, any person having 100*l.* may seize same to his own use, 3 Jac. I. c. 13. Killing in the night, between the hours of nine at night and four in the morning, from February 12 to October 12, any game, by any person, whether qualified or not, subject to same penalties as killing hares at that time of night, by 13 Geo. III. c. 80. as has been already shown. Every person qualified to kill game, shall, previous to his shooting at, killing, or destroying any game, deliver in writing his name and place of abode, if in England, to the clerk of the peace, if in Scotland, to the sheriff or steward clerk of the county where resident, and annually take out a certificate thereof, stamped with a two guinea stamp, 24 Geo. III. ses. 2. c. 43. s. 1. and the 31 of Geo. III. c. 21. an additional stamp of one guinea, making in all three guineas; and from and after the passing of this act, every such qualified person who shall so deliver, in England or Scotland, his name and place of abode as aforesaid, and require a certificate thereof, shall be annually entitled thereto, stamped as aforesaid, from clerk of peace, or his deputy, sheriff, or steward clerk, to the effect of the form in the act set forth, 24 Geo. III. ses. 2. c. 43. s. 3. Clerk of peace, &c. after he shall have signed such certificate, shall forthwith issue the same, stamped, to the person so delivering in his name and place of abode, and requiring the same, for which he shall be entitled to receive 1*s.* for his own trouble, 24 Geo. III. ses. 2. c. 43. s. 4. Neglecting or refusing certificates incurs like forfeiture, and which are recoverable in like manner, and with same costs as to game-keepers, as before mentioned; besides liable to pay the duty on such certificate, 24 Geo. III. ses. 2. c. 43. s. 4.

The time for sporting in the day is from one hour before sun-rising until one hour after sun-setting, 10 Geo. III. c. 19. The sporting season for bustards is from December 1 to March 1. For grouse or red-game, from August 12 to December 10. Hares may be killed all the year, under the restriction in 10 Geo. III. c. 19. Heath-fowl, or black-game, from August 20 to December 20, 13 Geo. III. c. 55. Pheasants, from October 1 to February 1. Partridges, from September 1 to February 12, 2 Geo. III. c. 19. Fowls, widgeons, wild ducks, wild geese, at any time but in June, July, August, and September, 10 Geo. III. c. 32.

From and after October 1, 1784, in all cases where the penalty by this act does not exceed 20*l.* justice of peace shall, upon information or complaint,

summon the party and witnesses to appear, and proceed to hear and determine the matter in a summary way, and upon due proof by confession, or upon the oath of one witness, give judgment for the forfeiture; and issue his warrant for levying the same on offender's goods, and to sell them, if not redeemed within six days, rendering to party overplus; and if his goods be insufficient to answer the penalty, shall commit offender to prison, there to be for six calendar months, unless penalty be sooner paid; and if party be aggrieved by the judgment, he may, upon giving security amounting to value of forfeiture, with the costs of affirmance, appeal to the next general quarter sessions, when it is to be heard and finally determined; and in case the judgment be affirmed, sessions may award such costs incurred by appeal as to themselves shall seem meet, 24 Geo. III. ses. 2. c. 43. s. 19. Witnesses neglecting or refusing to appear, without reasonable excuse, to be allowed of by the justice, shall respectively forfeit, for every offence, 10*l.* to be levied and paid as other penalties by this act, 24 Geo. III. ses. 2. c. 34. s. 20. Justice to cause conviction to be made out to the effect of the form set forth in the act 24 Geo. III. ses. 2. c. 43. s. 21. Justice may mitigate penalties as he thinks fit, so that the reasonable costs and charges of officers and informers for discovery and prosecution, be always allowed, over and above mitigation, and so as same does not reduce the penalty to less than a moiety, over and above the costs and charges, 24 Geo. III. ses. 2. c. 43. s. 22.

It is felony to take any swans that are lawfully marked, though they be at large; and so it is unmarked swans, if they be domesticated or tame, so long as they keep within a man's manor, or within his private rivers, or if they happen to have escaped from them, and are pursued, taken, and brought back again; but if they be abroad, and have attained their natural liberty, then the property of them is lost, and so long felony cannot be committed by taking them. Burn's Just. Tit. Game.

Same laws against shooting wild fowls as for shooting hares, by 1 Jac. I. c. 27. s. 2.

Every person, whether in pursuit of game or otherwise, going upon another's ground, without his consent, is considered a trespasser, and liable to an action of trespass; and for which a compensation in damages is recoverable, according to the malicious intent of the party, and the damage he may actually commit. But, in order to prevent trifling and vexatious actions, it was, by the 34 Eliz. c. 6. and 22 and 23 Chas. II. c. 9. and 8 and 9 Wm. and Mary, c. 11. enacted, that where a jury, who try an action of trespass, shall give less damages than 40*s.* the plaintiff shall recover no more costs than damages; in which case each party will have to pay his own costs, unless the judge before whom the action is tried shall certify that the trespass was wilful and malicious, which he is bound to do where it shall so appear; and it shall be required of him in court, immediately upon the trial; in which case the defendant must pay cost. All trespasses are considered wilful, where the defendant has been forewarned not to come upon the land; and malicious, where the trespass is evidently committed with intent to vex and distress the plaintiff. By 23 Eliz. c. 10. no person can, without the consent of the owner, with his spaniels hunt in any ground where there shall be corn or grain, which shall be carried or corded, until the same shall be shocked, cocked, or copped, upon the pain of forfeiting for each offence 40*s.*

Under these statutes, qualified as well as unqualified persons are included. A lord of a manor, even within his own manor, unless he have a grant of free-warren over another man's grounds, has no greater privilege than other qualified persons. In a few cases, however, the law excuses a trespass, as when in pursuit of foxes, badgers, and other beasts of prey; which are considered as noxious animals; but, in the doing of this, care must be taken to do no more injury than can be avoided, and in the case of hunting a fox or a badger, no man is justified in disturbing the soil to get him out of the earth, for though the law allows the hunting, it must be done in the usual and ordinary manner.

Offenders may be apprehended upon the spot by servants and others, and delivered to a peace-officer; and, if not then apprehended, a justice's warrant may be obtained for that purpose, upon the oath of a credible witness.

Using dog and gun, or dog and net, in pursuit of game, is considered but one offence.

Buyer or seller informing in three months against the other, and convicting him, is exempt from the penalty, and entitled to the same benefit as other informers.

The bare keeping of certain dogs is penal; but the keeping of a gun, unless used to kill game, is not so.

The act of parliament for preventing the stealing of dogs is as follows:—By the statute of 10 Geo. III. it is enacted, that after the 1st day of May 1770, if any person shall steal any dog or dogs of any kind or sort whatsoever, from the owner thereof, or from any person intrusted by the owner thereof with such dog or dogs; or shall buy, sell, receive, harbour, detain, or keep any dogs of any kind or sort whatsoever, knowing the same to have been stolen as aforesaid, every such person being convicted thereof upon the oath of one credible witness, before two justices of the peace, shall for the first offence forfeit and pay any sum not exceeding 30*l.* nor less than 20*l.*, and the charges of conviction. And in case such penalty shall not be forthwith paid, the offender to be committed to gaol for any time not exceeding twelve months, nor less than six, or until the penalty and charges are paid. Any person guilty of a subsequent offence, to forfeit and pay any sum not exceeding 50*l.* nor less than 30*l.* together with the charges, which penalties to be paid, one moiety thereof to the informer, and the other to the poor of the parish. On non-payment, the offender to be imprisoned for any time not exceeding 18 months, nor less than 12, or until the penalty and charges shall be paid, and be publicly whipped.

Justices to grant warrants to search for dogs

stolen. And in case any such dog or dogs, or their skins, shall upon such search be found, to take and restore every such dog or skin to the owner; and the persons in whose custody any such dog or skin shall be found, are liable to the like penalties and punishments. Persons aggrieved may appeal to the quarter-sessions, and the determination there to be final.

Persons detaining any estrayed dog after demand made, or wilfully destroying one, are liable to a special action and damages with costs.

GANGLION, in *farriery*, a moveable tumour formed any-where about the tendons of muscles and on the ligaments. Where it takes place in horses, or other cattle, the cure may be effected, by making an incision through its whole length, and afterwards dressing as in wounds in general; or it may be successfully extirpated, taking care not to wound the subjacent tendon or ligament, which can be generally avoided. Cutting away part of the cyst, and then digesting the rest away, by applying verdigrise or sublimate to it, is likewise a practice that generally proves successful.

GANGRENE, in *farriery*, a great and dangerous degree of inflammation, wherein the parts affected begin to put on a state of putrefaction. It hence appears to be a mortification in its beginning state, while yet the part retains some sense of pain, and some of the natural heat, by which last it is distinguished from a sphacelus, or thorough mortification, where there is no sense of warmth left.

The signs of it are the symptoms of inflammation suddenly disappearing, without taking away the cause; a dull sense in the part, softness, flaccidity, not rising again if depressed; pustules full of lymph, sometimes yellowish, at other times of a reddish colour, in and about the part inflamed. After this comes on a blackness of the flesh, &c. the signs of actual mortification.

In order to prevent a gangrene, the common means of resisting the progress of inflammation must be put in practice, giving bark and ammonia, where they do not prove effectual, in large quantities.

Gangrene, a disease in vegetables. See *Canker*.

GANTRY, a term applied to a beer-stand or frame for placing liquor-casks upon.

GAP, a breach or opening in a hedge. Openings of this sort are repaired in various ways, according to circumstances; but the best method would probably be by means of living plants of the same kind as the hedge, and of suitable size to it. See *Fence*.

GARGET, in *farriery*, a disease in the udders of cows, arising from inflammation of the lymphatic glands. It is also a distemper incident to hogs; and which is known by their hanging down their heads, and carrying them on one side, moist eyes, staggering, and loss of appetite.

In order to remove the disease in cows, where the inflammation is great, it will be necessary to bleed near the part; and in hogs, both under the tail, and the ears.

In the first case, the udders or diseased parts should have the milk frequently drawn from them, and be well rubbed with some emollient ointment, as hogs-lard, or marshmallows. And if the disease be obstinate, a drachm of calomel may be given every other day, for three or four times, as an alterative. When the disorder happens to hogs, they should have the same medicine in a smaller dose, as half a drachm, according to their age, with frequent warm stimulating cordial drinks.

Garget, in *farriery*, a disease in horses and other cattle, appearing with a swelling and inflammation of the head, particularly affecting the eyes and lips, and ultimately inflaming also the gums and tongue. It is sometimes contagious. In the cure, the creature should be blooded every day till the inflammation subsides. Immediately after the first bleeding, two ounces and a half of Epsom salts should be given, dissolved in a pint of warm ale; after which, the following drench has been recommended to be administered night and morning:

Take of warm ale, half a pint; salt of prunella, or nitre in powder, half an ounce; Venice treacle, a quarter of an ounce. Mix them well together, and give it for one dose.

And the animals should be kept clean, dry, and quiet. It may be necessary, however, to look into the mouth for blisters, which generally appear upon the tongue; and, if there are any, they should be broken, and dressed with ægyptiacum, or honey and vinegar. When the inflammation is likely to be considerable, local bleeding is very useful. With this view, some cast the animal on straw, and, bringing forth his tongue, with the point of a knife open the middle vein, for about half an inch, near to the root if it can be done.

Garget *in the Maw*, in *farriery*, is a dangerous disease of cattle, according to old farriers being caused by the beasts eating of crabs or acorns, which lie under trees, which they mostly swallow whole, without breaking or chewing, so that they lie whole in the maw, and do not digest. It is perceived by their drooping, and the heaviness in their head, as well as the hanging down of their ears. In the cure, it is advised to "let blood in the neck-vein."

GARGLE, in *farriery*, a disease in horned cattle, which is said to be an external hard swelling in the dew-lap, which afterwards spreads to the breast and throat. In the cure, it is recommended to "bleed largely, and then make an opening in the dew-lap where the swelling is," in order to promote a free suppuration; but a common rowel may answer the purpose equally well.

GARNER, a term used provincially to signify a granary, or repository for corn, also a binn, a mill, or a granary. See *Granary*.

GARTH, a provincial term, signifying a small garden, yard, backside, or croft.

GARZIL, a word employed in some districts to signify hedging wood.

GAS, a term applied to an aëriform fluid, which is of much advantage in the support and growth of plants. It is found, from a variety of facts and experiments which have been made by modern chemists,

that caloric, in its combination with bodies, is capable of volatilising many of them, and of reducing them to the aëriform state. The permanence of this state, in the temperature of the atmosphere, constitutes aëriform fluids or gases. It is necessary, therefore, in order to reduce a substance to the state of gas, to dissolve it in caloric, or the matter of heat. This substance combines with various bodies, with greater or less facility; and there are several which, at the temperature of the atmosphere, are constantly in the state of gas. There are others, likewise, which pass to this state at some degrees higher, and these are called volatile or evaporable substances. They differ from fixed substances, because these last are not volatilised, but by the application and combination of a large portion of caloric. It is clear, then, that all bodies do not indiscriminately require the same quantity of caloric to assume the gaseous state; and it will be found, that the proportion may be deduced from the fixation and concretion of these gaseous substances. In order to reduce any substance to the state of gas, the application of caloric may be made in different ways. The most simple method consists in placing the body in contact with another body which is heated. In this situation, the heat on one hand diminishes the affinity of aggregation or composition, by separating the constituent principles to a greater distance from each other; and, on the other hand, the heat unites to the principles with which it has the strongest affinity, and volatilises them. This process is according to the method of simple affinities; for, in fact, it consists of the exhibition of a third body, which, presented to a compound of several principles, combines with one of them, and carries it off. The method of double affinity may likewise be used to convert any substance into the gaseous form; and this is what happens when we cause one body to act upon another to produce a combination, in which a disengagement of some gaseous principles takes place. If, for example, the sulphuric acid be poured upon the oxide of manganese, the acid combines with the metal, while its caloric seizes the oxigene, and rises with it. This circumstance takes place not only in this instance, but on all other occasions, wherein an operation being performed without the application of heat, there is a production of vapour or gas. The various states under which bodies present themselves to our eyes, depend almost entirely upon the different degrees of combination of caloric with those same bodies. Fluids do not differ from solids, but because they constantly possess, at the temperature of the atmosphere, that quantity of caloric which is requisite to maintain them in that state; they congeal and pass to the concrete state with greater or less facility, accordingly as the requisite quantity of caloric is more or less in proportion. In respect to solid bodies, they are all capable of passing to the gaseous state; and the only difference which exists between them in this respect is, that a quantity of caloric is required for this purpose, which is governed by the following circumstances: by the affinity of aggregation, which connects their principles, retains them, and opposes itself to a new combination; by the weight of the constituent parts, which renders their volatilisation more or less difficult; and by the agreement and attraction between the caloric and the solid body, which is more or less strong or powerful.

And it may be further observed, that all bodies, whether solid or liquid, when they come to be volatilised by heat, appear in two states, either that of vapour, or of gas. In the first case, these substances lose, in a short time, the caloric which raised them, and again appear in their original form the moment the caloric finds colder bodies to combine with; but it is seldom that bodies thus divided resume their original consistence. This state is that of vapour. In the second instance, the combination of caloric with the volatilised substance is such, that the ordinary temperature of the atmosphere is insufficient to overcome the union. This is the state which constitutes the gases, or aëriform fluids. When the combination of caloric with any substance is such that a gas is produced, these invisible substances may be managed at pleasure, by the assistance of apparatus which have lately been appropriated to these uses. These are known by the name of Pneumato-chemical, Hydro-pneumatic apparatus, &c. The pneumato-chemical apparatus, which is generally employed, consists of a wooden vessel, usually of a square form, and lined with lead or tin: two or three inches beneath the upper edge there is formed a groove, in which a wooden plank slides, having a hole in the middle, and a notch in one of its sides; the hole is made in the centre of an excavation formed in the shelf, of the figure of a funnel. This vessel is filled with water or mercury, according to the nature of the gases to be operated upon. There are some which easily combine with water, and therefore require to be received over mercury. It is very well known, that gases may be extracted in various ways. When they are disengaged by fire, a recurved tube is adapted to the neck of the retort, one extremity of which is plunged in the water or the mercury of the pneumato-chemical vessel, and opens beneath the aperture in the shelf, which is in the form of a funnel. The junction of the tube with the neck of the retort is secured with the usual lute; a vessel filled with the liquid of the cistern is inverted upon the shelf over the aperture. When the gas is disengaged from the materials in the retort, it appears in the form of bubbles, which rise, and gain the superior part of the inverted vessel. When all the water is displaced, and the bottle is full of gas, it is withdrawn, by adapting a glass plate to its orifice to prevent its dissipation: it may then be poured from one vessel to another, and subjected to a variety of experiments, in order to ascertain its particular nature and properties. But when the gases are disengaged by means of acids, the mixture which is designed to afford them is put into a bottle with a recurved tube fitted to its neck; and this tube is plunged in the cistern in such a manner, that the bubbles of gas may pass, as in the former experiment, through the aperture of the funnel in the shelf of the vessel, in which the process is managed.

The great simplicity and convenience of the processes which are at present made use of in extracting the gases, and in analysing them, have contributed in a very high degree to the acquisition of the knowledge of aëriform fluids. And the further prosecution of the subject may probably lead to further knowledge in regard to the food of vegetables, and the consequent improvement of Agriculture.

Ammoniacal Gas, the vapour of caustic volatile alkali, which may be raised by heat into a permanent gas. It is readily and copiously absorbed by water, with which it forms a strong volatile alkaline spirit. It also dissolves ice as fast as if the ice were exposed to a hot fire. It unites with the marine or vitriolic acid gases, forming concrete ammoniacal salts; and with the gas of calcareous substances, with which it concretes into oblong slender crystals. It is also sometimes called alkaline gas, volatile alkaline gas, and alkaline gas.

Carbonic Acid Gas, a permanently elastic fluid, obtained from various substances, the distinguishing property of which is, that it is capable of uniting with the caustic calcareous earth, or quick-lime, dissolved in water, and of precipitating this earth from the water. Thus, when a sufficient quantity of it comes into contact with lime-water, the water is rendered of an opaque white colour, and the small particles of earth which produce this turbid appearance gradually sink to the bottom of the vessel, leaving the water clear, and free from the earth which had been dissolved in it; while the earth, thus separated from the water which had dissolved it, is found to have recovered its solid form, and remains united and combined with the gas. Whatever gas therefore is observed to have this property of combining with the calcareous earth dissolved in water, may be distinguished from other elastic fluids by the name of calcareous gas. Dr. Hales, and some others, have denominated this fluid fixed air, the impropriety of which term appears from considering first, that this fluid is fixed only when it is combined with the calcareous earth or other substance; and that it is the reverse of being fixed, that is to say, it is permanently elastic, whenever it is disengaged; and secondly, it does not possess the distinguishing properties of the fluid to which the word air has been immemorially assigned. Bergman calls this fluid the aërial acid; it is called by others mephitic acid, and mephitic gas: neither of which distinguishes it from other gases, all which (excepting common air) are mephetic or noxious to breathing animals, and several of which are better entitled to the title of acid. It may be observed, that calcareous gases are obtained from a variety of substances, and by different processes; as, from calcareous earths, fixed and volatile alkalies, magnesia, the juices of fruits, infusion of grains, and other vegetable matters, while they undergo the vinous fermentation, also animal and vegetable substances undergoing the putrefactive fermentation. This gas is likewise found in mines and other subterraneous places, also in most mineral waters, &c. It possesses, amongst other properties, that of extinguishing flame: one part of it with nine parts of air does not admit a candle to burn; when it is respired, it is fatal to animal life, and it resists putrefaction, by applying it to putrefying substances, but, in respect to agriculture, it has different important uses. See *Carbonic Acid.*

Hydrogene Gas, that sort of aërial or elastic fluid, that has been often known by the title of inflammable air. It is frequently found in mines, especially coal-mines, which sometimes take fire, and explode with considerable violence. It is obtained from iron, brass, tin, zinc, putrefying animal or vegetable matters, liver of sulphur, &c. The inflammable gases which have been principally examined, explode during their inflammation, yet many others burn very well without explosion. And Signor Volta has supposed the *ignis fatuus* to be inflammable gas that has arisen from marshy grounds, and also that the falling stars may have been kindled by means of electricity; for inflammable gas may be kindled by the electric spark, even when the electricity is not very strong. Inflammable gas is noxious to animals, but is not hurtful to vegetable life, of course may have some useful effect in the business of vegetation.

Muriatic Acid Gas, an aërial or elastic fluid obtained by means of heat, from spirit of salt. It is quickly absorbed by water, which becomes a spirit of salt more or less strong in proportion to the quantity of gas absorbed, and thus a stronger marine acid spirit may be obtained than by any other method. Ice is as quickly dissolved by this acid gas, as it is by a hot fire. It extinguishes flame; and when mixed with air, it gives to flame a beautiful green or blueish colour. It is highly injurious to the young buds of trees and plants.

Nitrous Gas, an aërial or elastic fluid, produced by dissolving in the nitrous acid either iron, copper, mercury, silver, bismuth, or nickel, &c. When mixed with air it produces heat, redness, a turbid appearance, and a diminution of the bulk of the air. It suffers no diminution upon being mixed with any other kind of gas than air; and, consequently, the diminution is greater when the air is purer. It is employed to measure the purity of the atmospheric air. It extinguishes flame, and is noxious to animals: but is absorbed by various liquors and fluids.

Nitrous Acid Gas, an aërial fluid, formed by the vapour of heated spirit of nitre, as discovered by Dr. Priestley. It is readily absorbed by water, and dissolves quicksilver. When it is mixed with nitrous gas, the mixture becomes red and turbid, the nitrous gas is diminished, and its power of diminishing air is lessened.

Vitriolic Acid Gas, an aërial fluid, raised by means of heat, and of mixture with oils, charcoal, or other inflammable substances. It is readily absorbed by water; and, when thus brought into the form of a liquid, it possesses all the properties of a vitriolic, or rather, perhaps, of the volatile vitriolic or sulphurous acid. And two kinds of gas are emitted from putrefying animal and vegetable substances, namely, one that renders caustic alkalies mild, and another that is of an inflammable nature.

Azotic GAS, an aërial fluid of a particular nature. See *Azote*.

GASCOIN, the inner thigh of an horse, which begins at the stifle, and reaches to the bending of the ham.

GATE, a frame of timber constructed with bars, and fixed upon hinges, in order to give a convenient passage into inclosed grounds.

The materials of which gates are constructed, whatever their nature may be, should always be well seasoned before they are used, as, without attention in this respect, they are soon tore to pieces by the heat of the sun; they should also be well and correctly put together. Oak is undoubtedly the best sort of wood for the purpose, where durability is the object; though some of the lighter kind of woods, as deal, willow, &c. will often last a great length of time, as, from their lightness, they are not so apt to destroy themselves. The lighter gates are made in the fore-parts, the better, provided they be sufficiently strong for the purpose they are to serve; and on this account the top bars may in many cases, as where horses are to be kept, be left considerably stronger than the others. If this be not done, they are liable to be broken by the animals rubbing their necks upon them, except where they are made very high. Gates are generally made eight and an half or nine feet in width, and from five to six feet in height; the bars being three or four feet broad, and five or six in number. In particular instances a smaller bar is introduced between the two lowermost ones, in order to prevent small animals getting through.

Gates are of different kinds, according to the particular custom of the district; but the principal sorts made use of are, the swing-gate, the folding-gate, the slip-bar gate, and the wicket, or turn-about gate. The swing-gates most commonly employed are represented at *figs.* 1, 2, 3, 4, 5, 6, in *pl.* XLV.

That represented at *fig.* 1. is made upon an improved principle, and much used in the northern districts; *a* is the projection on the fore-part of the *har-tree*, which rises nine inches, and on which the lower end of the diagonal bar passing upwards rests; *b b* the diagonal bar through which the three middle horizontal bars pass; *c c* a perpendicular bar fixed into the uppermost bar, six inches from the insertion of the diagonal one at *d*, and into the lowermost one at *e*; *f* the spring on the *fore-tree* by which it fastens. It is found to be a very strong and durable gate.

Fig. 2. is the most usual method of constructing a swing-gate, having only a simple cross-bar or brace. It is cheap and useful for common purposes.

Fig. 3. is an improved upright swing-gate, which is close, strong and ornamental, but too expensive for common purposes.

Fig. 4. is a common upright swing gate, which is useful where a close simple gate is required.

Fig. 5. is another improved swing-gate, recommended by Mr. Parker, of Shropshire, who observes, that the gate most commonly in use there, weighs "about 130*lbs.* without the iron work, and its dimensions are as follow:

	Inches	by	Inches.
Heel	5		4
Head	$2\frac{3}{4}$		$2\frac{3}{4}$
Rail near the heel	$3\frac{1}{4}$		3
Ditto near the head	3		$2\frac{1}{2}$
Bars near the heel	$3\frac{3}{4}$		1
Ditto near the head	$2\frac{3}{4}$		$0\frac{3}{4}$
One diagonal, and two perpendicular bars or lacings, each	$3\frac{3}{4}$		1

The diagonal bar rising from the lower part of the heel of the gate meets the middle of the rail, and the two upright bars are placed at proper distances between the middle and the head of the gate: these cross-bars must, he thinks, assist very much in keeping the gate together, but what is most to be guarded against is, its sinking at the head, and to prevent which, the gate" represented at the above figure "is well contrived."

He adds, that "the rail and the horizontal bars of this gate are similar to those above described; but the diagonal bar *c* is let into the lower part of the heel *a*, with a firm rest or butment, its upper end coming exactly into the angle formed by the rail *f*, and the head *b*; and it is also supported in its place by the upright bars *d* and *e*: from this arrangement it would seem, he thinks, that the bar *c* was likely to push the head *b* out of its place, were it not counteracted by the upper thimble being attached to, or forming one end of a flat bar of iron, which passing through the heel and along the top of the rail, extends to the head of the gate, having been hammered into an equal width and thickness at the part which goes through the head, and is finished at the end with a screw and nut: the iron bar is fixed to the rail with five or six strong nails, that secure the whole; and this appears to be much more likely to answer the purpose wished for, than any other plan he has ever met with. A gate of this kind has just, he says, been made for him by the direction of an ingenious mechanic: he cannot answer for its merits, but is assured, that it has been tried with great success. The weight of the iron strap or bar is 12*lbs.* which, at 5*d.* per *lb.* and 2*d.* for the screw nut, cost 5*s.* 2*d.*; but he questions whether a much lighter bar, even so small as half the weight of the above, would not be found to answer, if that of 12*lbs.* weight might be thought too expensive: the bars *c d e*, are $3\frac{1}{2}$ inches by $1\frac{1}{8}$, or a full inch"

Fig. 6. represents an useful swing-gate recommended by Mr. Bishton, of Kilsal, and which has been found to be little liable to be out of repair in comparison with any other.

Mr. Parker remarks, that for "gates of an ornamental kind, he does not know a better one than *a*, *fig.* 12. though it is strange that the heel and head, as well as the top, bottom, and semicircular rails, are all of the same dimensions, presenting $2\frac{1}{4}$ inches to the eye, by $2\frac{1}{2}$ inches in thickness; the upright bars being each a square inch in substance, and 5 inches asunder: this gate seems to require strap-hinges,

as represented at F. But in every ornamental gate of a larger description, he would recommend the bars *c d e*, *fig.* 5. to form a part, and consequently the strap of iron to keep the head in its place, which strap of iron must have a hole made in it for the handle of the jointed latch, when that fastening is intended for the gate, or if the head were thought to be the only part of such a gate which would be likely to give way, that might be confined to the rail by a much more simple contrivance."

It is however observed by Mr. Sommerville, in the second volume of Communications to the Board of Agriculture, that, from the great length of the bars, and the weight upon the hinges, gates of this sort are found to be very expensive; for, unless uncommon pains are taken to bind them very strongly together, the joints give way, and the gate falls to pieces; or the hinges, being overstrained by the great length of the bars, are either drawn or broken: this form is, therefore, he thinks, to be considered as a bad and an expensive one.

The double or folding-gate is shown at *figs.* 7 and 8. This kind of gate is found, from experience, to be much more durable than that just described; the bars, from being only half the length, render the joints of the gate not so liable to be broken, or the hinges to be hurt by straining. The difference in the original cost, the above writer says, consists only in the price of an additional pair of hinges.

At *fig.* 7. is a representation of a close folding-gate, which is convenient in different intentions. And at *fig.* 8. is an open folding-gate, proper for common purposes.

The slip-bar gate is represented at *fig.* 9. This, Mr. Sommerville thinks, perhaps, the most durable of any, especially where the gate-posts are of stone, with proper openings left for the reception of the bars. The only objection that can possibly be made to the slip-bar gate is, he conceives, the trouble of opening and shutting; which, when servants, or others passing through it, are in a hurry, occasions its being frequently left open. In other respects, it is preferable to every other description of gate, both in the original cost, and greater durability. It is to be noticed, however, he says, that upon the verge of a farm, or estate, especially where it is bounded by a high road, the slip-bar gate will not answer, as it does not admit of being locked, or secured in the same way as other gates; but in the interior of a farm or estate, it will be found the cheapest and most convenient sort of gate.

The turn-about, or wicket gate, is exhibited at *figs.* 10 and 11. These, it is remarked, are only used in cases where there is a necessity for leaving an entry for the people employed to pass backwards and forwards. This purpose they answer very well, and at the same time keep the field completely inclosed, as they require no trouble to shut them in the time of passing.

GATE-*Posts*, the posts or pillars to which gates are attached, and on which they mostly hang. These, where circumstances will admit of it, Mr. Sommerville says, should always be of stone, and, if possible, hewn stone; which, when properly constructed, last for ages: when formed from wood, oak is unquestionably the best, which should always be of considerable thickness. In many places, it is customary to plant trees for this purpose, and after they have attained a certain size and thickness, to cut them over about ten feet above the surface: where the trees thrive, they form, he thinks, the most durable of all gate-posts; in many instances, however, they misgive, and much trouble is necessary to repair the defect. Where the posts are made of *dead timber*, they should always be strong, and the wood well prepared; that part which is let into the earth should also be defended, by dipping it in coarse oil, charring, or giving it a coat of Lord Dundonald's coal-varnish; and all that is above ground, exposed to the action of the weather, should be well covered with one or two good coats of oil-paint. The expense of this preparation is but trifling, while the benefit is very great.

According to Mr. Parker, the substance of a gate-post should be from eight to ten inches square, or, for very heavy gates, a foot square would not be too large. If made of still larger size, it is better. And he says, that the steadiness of a gate-post depends, in a great measure, upon the depth to which it is set in the ground, which ought to be nearly equal to the height of it. Five or six feet is, in general, fully sufficient. But the posts may be kept in their places by a strong frame-work placed under the ground, extending between the posts.

At *fig.* 39, *a* is part of an oak-tree, without the bark; and since a well-constructed gate cannot be advantageously used, without suitable posts, it is necessary, he thinks, to make some remarks upon them. And as much expense and trouble may be saved, by a proper understanding in respect to their length and substance, he submits the following calculations:

It is stated, that an oak post 10 inches square, and 8 feet long, is sufficiently strong for the gate *fig.* 5. and it will contain $5\frac{1}{2}$ feet of timber, or exactly 5 feet $6\frac{6}{10}$ inches, the value of which must depend upon the quality of the timber; but for ordinary purposes, the lower part of a tree, of the dimensions *fig.* 39. will make four capital posts for use, though their form may not be thought ornamental, and will contain by customary measure $19\frac{1}{2}$ feet, or exactly 19 feet $6\frac{3}{10}$ inches; but the true measure of the part of a tree *fig.* 39. is 23 feet, or exactly 25 feet $1\frac{5}{10}$ inch: this leaves to the purchaser of round timber, taking in the sap, an advantage, he says, in the proportion of about 50 to 39, or upwards of 5 to 4.

ESTIMATE OF POSTS FOR GATES.

For 4 posts, containing $19\frac{1}{2}$ feet customary measure, of moderately good oak (several inches of which, in the length towards the root, is of little or no value taken together, say at 2*s.* a foot.	£.1 19 0

	Brought over	£.1 19	0
32 feet of sawing, say		1	0
		£.2 0	0

This being divided by 4, will, he says, amount to 10*s.* a post; which value, though apparently large, will be soon compensated in avoiding the continual charge of altering and propping insufficient posts: besides, these dimensions exceed the size of 10 inches square, even after allowing for the early decay of the sap on the round side of each post; insomuch, that a part of a tree of smaller dimensions might serve for the purpose: suppose the circumference of a part of a tree, without the bark, intended for 4 posts, were only 5 feet 8 inches (instead of 6 feet $3\frac{4}{10}$ inches, which is the circumference answering to the diameter of two feet), it would contain 16 feet $9\frac{6}{10}$ inches by customary measure, including the sap, which would be nearly equal in strength to four posts of 10 inches square; for each of such posts will measure in the true way, more than 5 feet, and the four posts *fig.* 39. would be reduced 7*s.* in price, or 1*s.* 9*d.* each, leaving their value about 8*s.* 3*d.* a piece. It would be frivolous to add illustrations upon questions, to which similar cases are detailed in every common book on mensuration of solids; but he feels it highly necessary to take notice of the outline of these facts, which, like other parts of the subject, are not generally practised upon: and further, should a gate of his recommendation be observed to lodge its head upon the ground, he begs to be considered, as *accountable* only for the *gate*, and not for the *post* on which it hangs, unless his recommendation in that respect, also, may have been duly attended to. And, it must be understood, that he is estimating the value of an oak gate-post of a certain strength, and not cavilling about the difference as to the customary and true measure of round timber; for the market-price of timber is considered as applying to a particular measure, and taking into the account the waste in converting round timber to use.

Hanging of Gates, the art of fixing or attaching them to the posts, by hinges, or other means, so that they may open and shut with ease and convenience. It is observed by Mr. Marshall, in his Rural Economy of the Midland Counties, that though he had attended much to the hanging of gates in Yorkshire, both with pivots and hinges, and had attained an adequate idea of the leading principle, yet not having committed it to writing, the true principle had escaped his memory, and a false one supplied its place; namely, that the only thing needful was to throw the gate out of its upright, so as to lean toward the post; no matter whether this inclination of the gate were obtained by the hooks or the thimbles.

Led by this false idea, he had conceived, he says, that the simplest, and of course the best way, to hang a gate, would be to put the hooks n exactly perpendicular to each other, and to give the fall by the thimbles alone. In consequence, he prepared a bottom thimble, with a clasp to take the hartree, and with an eye at each corner; in order that the gate might be occasionally hung on one or other side of the fence, as the occupation of the inclosure might require, and with this thimble hung a gate. The centres of the pins of the hooks being placed exactly perpendicular to each other, by a plumb line, the gate was hung on. But, instead of falling this way or that, it stood stationarily, wherever it was set. Thus finding himself at a stand, without inclination to remain long in so disgraceful a predicament, he set the workmen, he says, to other work, and himself to investigate the principles of gate-hanging.

After musing some time, with the gate in his hand, and sketching his ideas afterwards on paper, he saw clearly, and to demonstration, that the fall depended entirely upon the hooks: the axis or motion is given by the situation of the hooks, with respect to each other; and, whichever way the axis of motion inclines, that way the gate will fall. The theory of this principle is, he says, easily demonstrable; but it requires diagrams to explain it, and is merely elementary.

A gate should, he thinks, have what is called two falls; one at the post, to make it catch; and another at a right-angle to the gate-way, to prevent its standing open. The quantity of fall must vary with the uses and length of the gate, and the judgment or fancy of the hanger. If a gate has too much fall at the post, it is liable to beat itself to pieces; if too little, it does not catch with sufficient certainty, and is liable to be blown open by the wind, and thus becomes a deception, rather than a safeguard. On sufficient trial, he has found that, for field-gates, one inch and a half at the post, and an inch at the right-angle, give what appears to him a proper fall.

With respect to thimbles, the only use, he remarks, of their being made in this or that form, is to counteract the obliquity or cross-winding of the hooks: so that the gate, when shut, shall hang plumb and level; or every way in a perfectly upright position.

The way to ascertain the true position of the hooks is, he says, that of taking a plumbing line, or any string with a stone tied in it, and, looking along the line of the fence or gateway, to drive the hooks, or move the post, until the centre of the pin of the upper hook appears, by the line hanging perpendicularly before the eye, an inch and a half nearer the middle of the fence than that of the under one; and then looking along the line of the road, or perpendicularly to the gateway, see that the centre of the pin of the upper hook stands one inch nearer the middle of the road than that of the under hook; observing, likewise, that the pins of the hooks stand, not exactly upright, but in a line with each other, forming one direct axis of motion.

Gates being liable to sag, or droop, by hanging, they should be hung rather above than below the level. The top thimble being usually put into the middle of the hartree, with the eye as near to it as the shoulder of the hook will admit, the counter-

action, of course, depends on the bottom thimble. If the bottom thimble be made with two strong straps, to clasp the lower part of the hartree, as it always ought, with an eye on one side, or with two eyes, one on each side, and their centres three inches apart, and with necks projecting, when fixed, one inch farther from the hartree than that of the upper thimble, or, more accurately speaking, with the centre of the eye or eyes of the lower thimble standing an inch further behind the hartree than the centre of the eye of the upper one, the gate acquires, on a certainty, the required fall, yet hangs level and upright when shut.

The following directions are given, by the authors of the Northumberland Agricultural Report, for effecting this purpose. Having set the post perpendicular, let a plumb-line *a b*, be drawn upon it: on this line, at a proper height, place the hook *c*, *fig.* 1. so that it may project three inches and a half from the face of the post; and at a convenient distance below this place the lower hook *d* an inch and a half to one side of the perpendicular line, and projecting two inches from the face of the post; then place the top loop or eye two inches from the face of the *hawtree*, and the bottom loop three inches and a half: thus hung, the gate will, it is asserted, have a tendency to shut in every position. For if the weight of the gate be represented by the line *c d*, *fig.* 13, *pl.* XLV. this, by the resolution of forces, is resolvable, into other two *c e*, and *d e*, the former representing that part of the weight which presses in a perpendicular position, and the latter, that part of the weight which presses in a horizontal direction, and gives the gate a tendency to shut. This principle has, it is remarked, been long known and practised in hanging gates that open both ways.

It is remarked by Mr. Parker, in his able essay on this subject, that "a gate, when suspended by hinges, is a lever of the second kind, in which the weight is placed between the power and the fulcrum; for it is evident, that the hand applied to the head of the gate is the acting power, that the gate itself is the weight to be raised or moved, and that the hinges are the fulcrum or centre of motion." And that "when the hooks or pivots upon which a gate is hung are precisely in the same perpendicular line with each other, the gate will be at rest wherever it may be placed; and the same power which is required to move a gate thus suspended through any given arc of the circle, will be exactly sufficient to bring the gate back to its former position; in proof of which he would instance a common door to a room with plain hinges. But the smallest variation of the hooks from their perpendicular line, will attach to a gate so suspended one determinate line of rest, and no other; and from any part of the circle which the gate may be made to describe, it must have a constant tendency to fall to that line of rest." That "the line of rest for a gate will always be where the head of the gate approaches nearest to the ground, and from thence being moved half a circle to the right or left, it will there attain its greatest height, and support itself, or with a very slight assistance may be supported in equilibrio." But that "when a gate is in its line of rest, or in its opposite line of equilibrium, the two hooks by which it is suspended, and the centre of the gate's gravitation will be found to be in one and the same vertical plane: which will be easily understood by observing a common gate, whose hinges may be put on in any manner, however awkward or perverse. And when the hooks are in a perpendicular line with each other, it can admit of no doubt, that they must always be in the same vertical plane with the centre of the gate's gravitation, because they will be so with any third given point whatsoever.

"These general principles are also applicable to any common swing-gate, which has two or more pivots or hooks at the lower hinge, when the position of either one of the lower pivots is considered with regard to the upper hook." And, in further explanation of these principles, a figure is given, which is supposed "the outline of a gate 9 feet 2 inches long, from the fore-part of its head to its upper point of suspension, represented in the line of rest, as well as in the opposite line of equilibrium, shewing the velocity with which the gate is made to fall, from an elevation of 6 inches gained at the head, in attaining its line of equilibrium; estimated from the line of rest, by means of the position of the two hooks, and the proportionate extra length of the lower thimble." It is added, by the author, that "the line of fastening should be 22 deg. 30 min. or $\frac{1}{16}$ part of a circle short of, or within the line of rest; and consequently the corresponding line of equilibrium will also be 22 deg. 30 min. short of the greatest extent of the gate's opening." But, however, in order "to prevent the gate being left unshut, it is advised that a short post should be placed at about half the distance between the road to be passed, and the fence adjoining the hanging-post, that is, 22 deg. 30 min. within the line of equilibrium; so that the gate should not open from its line of fastening more than about 135 deg. which will answer every purpose; and the hinges must be so adjusted, that the gate shall be perfectly upright at its line of fastening." It is conceived, that "a gate suspended in this manner cannot be left open, excepting in high winds, but will shut of itself, though not with an uniformly accelerated motion, as might be supposed; its velocity being rather increased, as it passes the middle part of its semi-circular course, and retarded again as it approaches its line of rest, coinciding with the proportionate rise of the head; allowing only for such acceleration as must be acquired while the gate, in falling with a continued motion, recedes more and more from the line of equilibrium: as the versed sine of the angle, formed by the gate with its line of rest, is to the length of 110 inches, which is the made radius; so will be the corresponding rise of the head of the gate to $3\frac{7}{16}$ inches, or half the whole rise of the gate's head, at any given angle within the quadrant, and the rise in the head afterwards will be as the cosine of any given angle, formed by the gate with its line of equilibrium, in describing the complement of that angle, is to the length of the gate, or radius; so will be the corresponding rise of the head of the gate, to the remaining $3\frac{7}{1}$ inches;

which cosine of the angle formed by the gate, with the line of equilibrium, is equal to the sine of the complementary angle, or angle of the gate's progress, from a radius at right angles to, or equidistant from, the lines of rest and equilibrium, in performing its supplementary course. Thus it is evident, that though the rise of the gate at the head in the first 90 deg. or half of its semicircular course, be $3\frac{7}{10}$ths inches, yet in the first and last 22 deg. 30 min. of its course, it will rise only $\frac{1}{4}$ of an inch, or exactly $\frac{6}{24}$ths and $\frac{69}{116}$ths or a 24th in each respectively: and respecting the quarter fractions, the rise of the gate's head, and corresponding velocity of the gate's fall, in equal eighth parts of its semicircular course, is nearly in proportion to the numbers 6, 16, 26, 32, and then inversely, 32, 26, 16, and 6. And in order to illustrate the matter still more clearly, the author adds a representation of the horizontal section of two hooks for a right-handed gate, opening one way, brought into one place of observation, the upper hook, the lower hook, the line of fastening, the line of rest, and the line of equilibrium. The diameter of the hooks $\frac{13}{16}$ths of an inch, which is the proper size for a common gate. The horizontal distance of the lines falling from the two hooks, being $\frac{15}{12}$ths, or $\frac{3}{4}$ths of an inch, is the measure adapted to hinges which are 40 inches asunder. In adjusting the hinges, it is necessary that the upper thimble should incline $\frac{1}{4}$ of an inch from its centre, towards the hanging-post, and that the lower thimble should be screwed into the heel of the gate $\frac{1}{4}$ of an inch out of the straight line, inclining in the opposite direction, that is from, instead of towards, the hanging-post, both the thimbles together making a variation of the $\frac{6}{12}$ths of an inch, and to correspond with this variation, the upper hook should measure, from the centre of the pin to the shouldering, about half the thickness of the heel of the gate, as the $\frac{1}{6}$th inch inclination of the upper thimble will allow sufficiently for the gate hanging clear of the post. The longer hook must be $\frac{6}{12}$ths inch longer than the upper hook, and must be driven into the gate-post $\frac{1}{6}$th inch out of the perpendicular line of the perforated part of the gate-post, in which the hooks are to be received; as the lower thimble must also exceed the upper thimble in length $1\frac{3}{4}$th inch, supposing the gate to be a right-angled parallelogram; or, at least, the rail and heel to be at right angles with each other, else the lower thimbles must be extended by a washer, to make up the deficiency, which, however, will not at all interfere with the velocity of the gate's fall; because the hooks are the centre of motion, upon which all adjustment, as to the gate's fall, depends: the places of the thimbles influencing only the upright position of the gate when fastened. The numbers of $\frac{3}{12}$ths rather surpass, it is observed, the precise measure of their respective sides of the triangle, but are nearer to the truth in calculation, than any workman could attain in applying these directions; for, in neither case, do they exceed their true measure so much as $\frac{1}{24}$th of an inch, and therefore, in the one, the clear sum of $\frac{1}{2}$ inch is assumed for general purposes and should the hinges be less than 40 inches asunder $\frac{1}{2}$ inch will be rather too much; or, were they to be more than 40 inches distant from each other, $\frac{1}{2}$ inch, on the contrary, would be rather too little for the just proportion."

"It is certain," the author says, "that a small space must be lost in hanging a gate, though the hooks and thimbles be made with the greatest exactness; for the weight of the gate will draw the upper thimble to bear upon the hind part of the upper hook, and will press the lower thimble against the fore part of the lower hook: this must, however, be trifling where the hinges are well fitted, and no allowance is made for it in the drawings which he has given; because the lower thimble gains as much upon the upper one by their being placed $\frac{1}{2}$ inch, that is $\frac{1}{4}$ inch each, out of the plane of the gate's extension, as appears by the difference of the sides of the triangle numbered $\frac{14}{12}$ths, and $\frac{15}{12}$ths equal to $\frac{1}{12}$th inch, by the measure of $\frac{15}{12}$th, which is assumed but nearly about $\frac{1}{14}$th inch more, as stated above; or, on the whole, equal to $\frac{1}{8}$th inch, which is a good general equivalent for the loss in hanging a gate, and will usually be sufficient to preserve the upright position of the gate when fastened, without having recourse to a washer at the lower thimble."

It is stated, that the "velocity as above given to the gate's fall will be commonly sufficient, without any care of oiling the hinges; but the effect of wind cannot be counteracted in gates by any good construction of the hinges; for were a velocity given to a gate's fall, equal to the resistance of so powerful an agent, the gate would soon want repair, from the constant violence of its shutting, and be so much the heavier in the hands of a horseman: besides, when a strong wind blew in the same direction as that of the gate's fall, no man on horseback would be able to withstand its force; and well-constructed gates are most liable to be acted upon by wind from their wide extent of surface; but if passengers are so careless as to leave gates open under such circumstances, there will be one satisfaction remaining; that is, as soon as the wind ceases, the hinges must resume their property, and the gates fasten of themselves."

The writer gives different directions for ascertaining the proper position of the hooks, in cases where the hinges of gates are more or less than forty inches asunder; in proving the truth of which, he says, "suppose a gate to be 110 inches long, and that it is intended to rise at the head $6\frac{7}{8}$ inches in its semicircular course, from the line of rest to the line of equilibrium, then as the length of the gate is to the distance between the two hinges, so will be $6\frac{7}{8}$ inches to double the horizontal distance of two perpendicular lines, one falling from each of the hooks." Or, "take any other distance of the hinges from each other, and the required extra length of the lower thimble may be found by placing the numbers 110, and $6\frac{7}{8}$, as the first and second term of a rule of three proportions, and the new distance of the hinges must be the third term, the answer divided by two, will be the sought for horizontal distance of the two, the perpendicular lines falling from the hooks (adding the loss in hanging the gate), the answer for one is the measure for the other."

It is conceived, that "these general rules will find a tolerable accurate measure in all cases; for where a gate, or wicket, is short and light, the friction of the hinges will be less in two respects, both by the diminished pressure on the hooks, from the gate's lightness, and the reduced diameter of the pivots, which will supply what is wanting in the weight or momentum of the gate. On the other hand, when the gate is long and heavy, its increased weight, or momentum, and its length as a lever, will be opposed to the additional frictions of the hinges." And further, that "in cases where old hinges are badly made with large hooks or deep thimbles, that difficulty is to be met by taking the proportion for the distance, of the two hinges, from each other, at five or ten inches more than it really may be, with reference to the given table, or by adding something to the usual horizontal distance, of the lines falling from the hooks. But when the thimbles are of a long cylindrical form, they are extremely apt to bind upon the hooks, and will sometimes put a dead stop to the gate's motion. With such thimbles, the attempt of adding to the velocity of a gate's fall, may only increase the binding or friction, and the remedy of this defect, therefore, is to make the hooks much smaller than the thimbles; in new thimbles no form, but that of annular or ring-like, should be admitted. But by the lower thimble being furnished with a screw of equal diameter throughout its length, its extra length may be regulated to so great a nicety as half a turn of the screw, and may either be let into the heel beyond the shouldering, or lengthened out by a washer, as circumstances require, in adopting it either for hinges, which are less than forty inches asunder, or the contrary, without the help of a blacksmith, or any fresh forging, which is always troublesome and expensive. And if a gate sinks at the head, without any fault in the hanging-posts or hooks, the lower thimble may be lengthened out, to bring the gate upright, and the hooks remain unaltered."

It is added, that "the gate-posts being fixed about eight feet nine inches asunder, will be adapted for a gate nine feet long, or nine feet two inches, including the thimbles; the thimbles being attached to the gate in the manner above directed, let the gate be supported where it is to hang and fasten, and then drive in the upper hook, at a convenient distance from the edge of the hanging-post, so that the upper hinge shall not be in the way of any carriage passing the road, but at the same time so near to the edge of the post, as to lose no more room from the road than is unavoidable by the head and heel of the gate, extending a little upon the two posts. It is not necessary to the gate, that it should lap against the hanging-post at all, but since the head ought to meet the falling-post at least with half its substance, or from that to two inches, the hanging-post should be nearly as much covered by the heel, for the sake of uniformity.

"When the upper hinge is fitted, the gate ought to be supported upright, for ascertaining the place of the lower hook, and if the thimbles are properly put on, the position of the lower hook cannot be mistaken. Both hinges being fitted, it remains to be found, whether the hooks are in their exact places; for this purpose take two plumbed lines, with fine threads, and heavy even-sided plumbs: if the hooks are well finished, the observation respecting their centres may be taken, by fastening the plumbed lines round the hooks, and letting them fall from the outside of similar parts of the hooks; forty inches being the given distance of the hinges, the horizontal distance of the two lines falling from the hooks should be $1\frac{1}{4}$ inch, and in a line which forms an angle of 22° 30′ with the gate's line of fastening: take, therefore, a common two-feet rule, and having opened the legs to the angle 22° 30′, place one side of it against the plumbed lines, which ought to answer to the measure of $1\frac{1}{4}$ inch, while the other leg of the rule should be parallel to the gate's line of fastening; a slight blow or two with a hammer, on one or both of the hooks, in the direction necessary, will complete the adjustment, and the gate will be found to shut of itself for any time within 135°, from its fastening, and without violence, whether open to the smallest, the greatest, or any intermediate angle prescribed by the short post, which should be placed to meet the middle part of the gate, at the angle of about 135° from the line of fastening. Further, it might be prudent before the short post were put down, to ascertain at what line the gate will stand open, or be poised by the friction of its hinges, towards the line of equilibrium, which will discover how near the workmen may have adjusted the line of fastening to 22° 30′ short of the natural line of rest; and if the gate is found to fall properly, the short post may be put up accordingly, though the method described may not have been minutely pursued; taking care that the short post be sufficiently within the line of equilibrium, and that the gate set off from the short post with a velocity equal to overcome any increased friction by rust of the hinges; for oil should not be used at all, as its occasional aid is not to be depended upon."

It is observed, that "indifferent gate-posts are liable to get out of their right position; the constant weight of the gate must have a tendency to pull the hanging-post inwards; the fall of the gate may make the falling-post recede from the direction of the frequent blows it receives, and heavy carriage-wheels passing near the posts, will occasion them to open outwards, and the natural or artificial slopes of the ground adjoining gate-posts often affect their upright position, and decline them from the higher ground, and many other causes, produce similar effects; to obviate which, many contrivances have been recommended, such as mortising the pair of gate-posts together by cross pieces of timber under the road; but the most effectual preventive of the evil appears to be that of letting down the posts very deep into the ground, which will supersede the expense of cross timbers, and in gaining a firm hold at their basis, they will be the better secured both from natural and accidental displacement. Gate-posts for common gates should be from eight to eight feet and a half in length.

"Care is also to be taken, in hanging a gate, to choose the best side for it to open; in doing which

there are two circumstances to be considered; the principal one is, that there may be plenty of room for a servant on horseback to hold the gate while a carriage passes, and the other is to avoid its opening against any cross-road or path, and to which some attention is due to the trespass of cattle from a common road or otherwise; and it is thought more secure for a gate to open against that side from which the trespass may be most apprehended. In some cases, it is advisable to furnish a hanging-post with a pair of hooks, on both sides of it, so that the gate can be shifted as occasion may make it convenient.

"A key-hole and cotter may be put into the lower hook, to secure the gate from being taken off its hinges for idle purposes; or a stud rivetted to one side of either of the hooks, with a little notch cut in the strongest part of the adjoining thimble, is a simple and good contrivance, whereby a gate is prevented from being taken off the hinges when shut; but is easily taken off, at some one part of its course, when required, where the stud comes opposite to the notch, and admits the thimble to pass over the studded hook. And it is not uncommon to see one hook driven into the post with its point upwards in the common way, and the point of the other hook in the contrary direction, which is an effectual mode of keeping the gate on its hinges, but it has the inconvenience of not permitting the gate to be removed without drawing one of the hooks.

"The same principles are applied in the hanging of gates on the contrary sides, and likewise to those of swing-gates, full explanation of which may be seen in the very useful Essay referred to, as well as the method of sawing timber for gates and gate-posts."

It is suggested "that the common field-gates admit of a material distinction from road-gates in several respects; for, as to those, which are used very seldom, or are generally locked, it is of little consequence, so that the fence is made complete, whether they shut of themselves or not: and some people think that a light high gate is preferable to a low and heavier one; but he has heard a gate of about $4\frac{1}{2}$ feet high recommended for several reasons, and particularly as a fence against horses; because the top rail would meet their wind-pipes instead of their chests, and being able to put their heads over it, they would be the less likely to force it with their rumps." And that "a gate opening out of a field into a public road, should be such as no one could easily get over, with upright pales for instance, sharpened at the top, and it might be higher than usual: there is no objection to such gates opening double, as folding-doors, and he would prefer the hooks for hanging them to be perpendicular to each other, so that the gates should remain wherever they might be placed; and no other fastening ought to be allowed but a lock and key: this supposes that there is no common road or path through the field." But, "in very heavy lodge-gates, and turnpike-gates, he has seen the lower hinge contrived in such a manner as to have a piece of iron let into a stone, with the top of the iron rounded and bevelled acutely towards a point, and a socket which may be fastened to the heel of the gate with screw-pins and nuts; and the socket is of course less acute than the bevel to be received, so that as little friction as possible may be occasioned in opening the gate by the twist of the hinges, which in neither case will be perpendicular to each other. The pivot is well protected from rain and dirt in this manner, but I should always prefer the common hooks and thimbles of a proper strength; and if it were thought necessary, the gate might be in part supported by a small roller or caster placed under the heel. And he has also seen the lower hinge of a swing-gate formed with four hooks, or pivots, the two middle ones being projected a little further from the hanging-posts than the others, and the part attached to the gate indented to answer the hooks: but the same objections apply to this as to those above.

Table of Proportion in regard to Hooks and Thimbles, supposing a Gate to be a right-angled Parallelogram, set forth in Inches and twelfth Parts of Inches.

Distance from Thimble to Thimble.	"Horizontal Distance of Two perpendicular Lines, one falling from each of the Hooks."	Extra Length of lower Thimble.	Distance from Thimble to Thimble.	"Horizontal Distance of Two perpendicular Lines, one falling from each of the Hooks."	Extra Length of lower Thimble.	Distance from Thimble to Thimble.	"Horizontal Distance of Two perpendicular Lines, one falling from each of the Hooks."	Extra Length of lower Thimble.
12	$\frac{4}{12}$	$\frac{7}{12}$	29	$\frac{9}{12}$	1	46	$1\frac{3}{12}$	$1\frac{6}{12}$
13	$\frac{4}{12}$	$\frac{7}{12}$	30	$\frac{10}{12}$	$1\frac{1}{12}$	47	$1\frac{3}{12}$	$1\frac{6}{12}$
14	$\frac{4}{12}$	$\frac{7}{12}$	31	$\frac{10}{12}$	$1\frac{1}{12}$	48	$1\frac{4}{12}$	$1\frac{7}{12}$
15	$\frac{5}{12}$	$\frac{8}{12}$	32	$\frac{10}{12}$	$1\frac{1}{12}$	49	$1\frac{4}{12}$	$1\frac{7}{12}$
16	$\frac{5}{12}$	$\frac{8}{12}$	33	$\frac{11}{12}$	$1\frac{2}{12}$	50	$1\frac{4}{12}$	$1\frac{7}{12}$
17	$\frac{5}{12}$	$\frac{9}{12}$	34	$\frac{11}{12}$	$1\frac{2}{12}$	51	$1\frac{5}{12}$	$1\frac{8}{12}$
18	$\frac{6}{12}$	$\frac{9}{12}$	35	$\frac{11}{12}$	$1\frac{2}{12}$	52	$1\frac{5}{12}$	$1\frac{8}{12}$
19	$\frac{6}{12}$	$\frac{9}{12}$	36	1	$1\frac{3}{12}$	53	$1\frac{5}{12}$	$1\frac{8}{12}$
20	$\frac{6}{12}$	$\frac{9}{12}$	37	1	$1\frac{3}{12}$	54	$1\frac{6}{12}$	$1\frac{9}{12}$
21	$\frac{7}{12}$	$\frac{10}{12}$	38	1	$1\frac{3}{12}$	55	$1\frac{6}{12}$	$1\frac{9}{12}$
22	$\frac{7}{12}$	$\frac{10}{12}$	39	$1\frac{1}{12}$	$1\frac{4}{12}$	56	$1\frac{6}{12}$	$1\frac{9}{12}$
23	$\frac{7}{12}$	$\frac{10}{12}$	40	$1\frac{1}{12}$	$1\frac{4}{12}$	57	$1\frac{7}{12}$	$1\frac{10}{12}$
24	$\frac{8}{12}$	$\frac{11}{12}$	41	$1\frac{1}{12}$	$1\frac{4}{12}$	58	$1\frac{7}{12}$	$1\frac{10}{12}$
25	$\frac{8}{12}$	$\frac{11}{12}$	42	$1\frac{2}{12}$	$1\frac{5}{12}$	59	$1\frac{7}{12}$	$1\frac{10}{12}$
26	$\frac{8}{12}$	$\frac{11}{12}$	43	$1\frac{2}{12}$	$1\frac{5}{12}$	60	$1\frac{8}{12}$	$1\frac{11}{12}$
27	$\frac{9}{12}$	1	44	$1\frac{2}{12}$	$1\frac{5}{12}$	61	$1\frac{8}{12}$	$1\frac{11}{12}$
28	$\frac{9}{12}$	1	45	$1\frac{3}{12}$	$1\frac{6}{12}$	62	$1\frac{8}{12}$	$1\frac{11}{12}$

But to render these principles more evident, the following figure and description of the method of hanging gates, is given by Mr Parker. At *fig.* 14, is a section of two gate-posts, with the proper position of the hinges of a gate, which is designed to open one way, displaying the line of fastening, the line of rest, and the line of equilibrium, which two last lines are in the same vertical plane, both with the hooks, and with the centre of the gate's gravitation; and at about 1-16th part of a circle within the line of equilibrium, a short post is fixed in, to prevent the gate opening too near upon its equilibrium, and thereby becoming liable to be left open. *Fig.* 15 is the upper thimble for a common gate, which is less expensive, but by no means so good as when the strap extends to the whole length of the gate, as described below; this thimble is twisted 1-4 of an inch bearing towards the hanging-post. *Fig.* 16 is the lower thimble of a gate proportioned to the upper thimble *fig.* 15, as $1\frac{3}{4}$ inch is to 3 inches. in regard to the distance between their centres and shoulders respectively. These thimbles are adapted for a gate whose hinges are 40 inches asunder, and as 40 is to $1\frac{1}{4}$, the difference in this instance, so should be any other distance from hinge to hinge, to the proportionate difference or extra length of the lower thimble; and the greater the extra length might be made, over and above such proportion, the greater must become the velocity of the gate's fall, or tendency towards the line of rest; until its course is arrested by the fastening-post 1-16th part of the circle, or 22° 30′ short of the line of rest. The lower thimble is let into the gate by a screw of equal substance throughout its length, or not tapered, in order that the adjustment of the thimbles, as to the velocity of the gate's fall, may be regulated to so great a nicety as half a turn of the screw: and the thimble may either be let into the heel of the gate, or lengthened out by a washer, as occasion shall require. The position of the thimbles, in respect to each other, must be favoured also by the lower thimble, which being placed 1-4th of an inch out of the middle of the heel of the gate, in the contrary direction of the upper thimble, the whole difference, as to the distances of the two thimbles from the hanging-post, will be one-half of an inch; and their vertical plane, which is the same as that of the lines of rest and equilibrium, will form an angle with the line of fastening of 22° 30′, or 1-16th part of a circle; this adjustment, in effect, adds 1-12th of an inch to the extra length of the lower thimble, so that, by a plumb-line, it will be found (when the gate is hung upright, as it always ought to be) that the actual extra length of the lower thimble, or horizontal distance of the two centres from each other, will be $1\frac{1}{4}+\frac{1}{12}=1\frac{1}{3}$ inch. *Fig.* 17 is the upper hook. *Fig.* 18 is the lower hook, with key-hole and cotter, and is half an inch longer from its centre to the shoulder than the upper hook, in order to answer the thimbles; the actual position of the hooks, with respect to each other, or rather the horizontal distance of two perpendicular lines, one falling from the centre of each of the hooks, will be about $1\frac{1}{4}$ of an inch only; for if the hooks and thimbles are made to fit properly, each hook will then be more than 1-16th part of an inch smaller than its thimble; for as the whole loss in hanging a gate need not be so much as 1-8th of an inch, or not more perhaps than 1-12 (which exactly balances what is gained in the thimbles), the extra length of the lower thimble before it is fixed to the gate, and that of the lower hook before it is driven into the post, ought precisely to accord with the dimensions expressed in the plate, supposing the distance of the two hinges to be 40 inches." And it is added, that "the diameter of the hooks should be about 13-16ths of an inch, and the perforated parts of the thimbles when made to fit such hooks will be about 14-16ths, that is, 7-8ths of an inch diameter: for pivots of this size, the above calculations are suited, as to the velocity of a gate's fall; and the thimbles should be made of rounded iron, that the friction may be reduced by the smallness of the surface to be affected thereby: as is shewn by Mr. Vince's experiments "On the Motion of Bodies affected by Friction." Vol. LXXV. Philosophical Transactions of the Royal Society of London. And when old iron-work is made use of, wherein a larger surface is exposed to friction, 1-8th, or 1-4th of an inch, as may be sufficient, added to the common extra length of the lower thimble, will be the readiest means of counteracting the extra friction." But, "if the heel of a gate be not at right angles with the rail, or the perforated parts of the thimbles be greater than the proportion allowed for, the deficiency, in either or both cases, must be supplied by adding to the length of the lower thimble."

We have already shewn, at *fig.* 5, "a complete gate for opening one way, and constructed in such a manner, that it shall not sink at the head, as ordinary gates are apt to do. The bars are let into the middle parts of the head and heel, and the lacings are tapered for finishing upon a level surface with the heel, head, and rail; as is evident in the following directions for the sawing out the timber, which should be of *kind* oak, not too *tough*, and entirely free from sap." But "the waste in planing and finishing a gate may be allowed for or not, as the gate is desired to be a little more or less strong." But, "when the timber is good, it is reduced so little by being planed and finished into a gate, that no allowance need be made for the waste; or, at all events, if the sawer attends to the dimensions recommended, the gate will be quite strong enough for its size."

	Length.		*Greatest thickness.*	*Tapered to.*
	Feet.	In.	In. by In.	In. by In.
Heel -	4	4	$4\frac{1}{2}$—$3\frac{1}{2}$	
Head -	4	4	$2\frac{1}{2}$—$2\frac{1}{2}$	
Rail -	9	0	$3\frac{1}{2}$—$3\frac{1}{2}$	$2\frac{1}{2}$—$2\frac{1}{2}$
5 Bars -	9	0	$3\frac{1}{2}$—1	$2\frac{1}{2}$—$\frac{3}{4}$
Diagonal Lacing	9	6	$3\frac{1}{2}$—$1\frac{1}{2}$	$2\frac{1}{2}$—1
Larger Upright Lacing. -	2	8	$3\frac{1}{4}$—$1\frac{1}{4}$	
Smaller ditto	2	8	3 —$1\frac{1}{4}$	

which will be found to form a well proportioned gate, the whole of the eight parts at the head presenting to the eye $2\frac{1}{2}$ inches, and seven out of the eight parts at the heel, that is, all excepting the heel itself, present $3\frac{1}{2}$ inches." And in it "the diagonal lacing is fitted into the heel by a strong butment, even with the lowest bar, and its smaller end meets the upper angle at the head, and is confined laterally by two upright lacings; this would keep up the rail, provided the head were not pushed forward, and that is prevented by an iron strap of equal length to the gate, being attached to, or forming a part of the upper thimble in the first instance, where it holds the heel of the gate by the shoulder of the thimble; it is afterwards screwed to the rail at proper distances; and lastly, secures the whole work together, by a screw-nut, rounded and let into the front of the gate's head. The iron strap is about an inch by a quarter of an inch in substance, for one half of its length, when it is tapered towards the head of the gate. At the end nearest to the thimble, it is made stronger for a few inches; and close to the shoulder of the thimble, it should be as much as half of an inch thick; the edges are chamfered off, and the whole appears to be gradually tapered from the heel to the head of the gate, widening a little round the hole which is left for the upright part of the latch adjoining to the handle. By this arrangement, the gate is in fact suspended by the iron strap and rail, instead of the heel, which assists greatly in preventing any strain upon the mortises by the gate's own weight, or otherwise."

The writer says, he "cannot imagine a gate of a more durable construction, and it seems particularly well calculated for *road-gates*. As in respect to a field, through which there is no common road, it is immaterial what sort of gates may be used, so that they be made secure against cattle."

Fastenings of Gates. It is further observed by the same writer, that most blacksmiths have favourite notions of these fastenings, and that from their variety, it is only necessary to consider such as have been found useful on trial. The fastening, *fig.* 19, "is remarkably easy for a horseman to open, and as difficult, if not impossible, to be opened by cattle: the upright wire of the latch is furnished with a guard, and the mortise of the head of the gate, through which the latch passes, is finished with sheet iron escutcheons, like those at *fig.* 22, the fastening being completed with the catch 21, having a button in the place of the ring. *Fig.* 20, is a common peg-latch for the head of a gate, with a guard to render it safer for cattle, which might run against it when the gate is open; and this forms a very secure fastening, either with or without the guard, when attached to the catch, *fig.* 21; but it is thought very inconvenient for horsemen, and particularly so for those who are not accustomed to it. *Fig.* 21 is the catch adapted to the latch, *fig.* 20. *Fig.* 22, represents two sheet iron escutcheons, and a pattern for a strong latch, which is executed in cast-iron 3-4ths of an inch thick. *Fig.* 23 is the catch belonging to *fig.* 19, to be made also of cast-iron, 1 inch thick. *Fig.* 24 is a hasp with a peg, of which the stud passes through the lower hole, but is too large to pass the upper hole, and therefore cannot be detached from the hasp: this may be made very useful in the fold-yard, &c."

The above author states, that "the double drop catch, *fig.* 25, has been used for some time in parts of Shropshire and Staffordshire, and that he took no small pains to improve it: he adapted it for fitting an angle of a post, of which *fig.* 26, is an horizontal section, and the screw-pin in the centre is made to answer two purposes: that of attaching the iron work more firmly to the post, and also of returning the points of the drop catches as often as either of them is driven upwards by the latch, the catch being thus instantly repulsed into its former position, before the gate has time to recoil beyond it." And he supposes, that this "sort of catch is calculated for a swing-gate, which, having been opened either way, falls to its line of rest, but is prevented from passing it by the obstruction of one of the catches; while the other catch giving way for the latch, drops again, and the gate is completely fastened." And he "afterwards applied the same principle to a single catch, for a gate to open only one way, *fig.* 27, in which he conceived that he had been very successful."

He says, that "it was next to be determined what kind of latch was most proper for these catches, and he found that the best contrivances for baffling cattle, were apt to puzzle his visitors, whose convenience was entitled to a share of his attention." He "at first tried an iron peg, *fig.* 28, to be driven into the head, opposite the top-rail, for a road-gate, and when it was to be placed lower for a fold-yard, or common field-gate, to be fastened with a screw-nut, both of which are represented in the figure. He then found it necessary to add a handle to the drop, *fig.* 27, but his friends would still insist upon it, that it was a two-*handed* fastening, and very inconvenient for horsemen; he therefore soon discontinued the iron peg, in regard to the double catch, though he approves of it for some purposes." He says, "it certainly never can be opened by cattle, and he thinks it would be easy enough for a horseman to open, when he became acquainted with it; yet should he take fast hold of the handle of the catch, with the fore part of the hand, as might be expected, in raising the drop, he will detach that hand from the gate, and he must then seek the aid of his other; though by placing the thumb or palm of the hand upon the drop catch, and reserving the full liberty of his fingers, he may open the gate very well with one hand; but when the catch is upon the contrary side of the gate to that of the horseman, it will not be quite so convenient, for the fingers or fore-part of the hand must in that case be employed upon the catch, while the thumb opens the gate. A great advantage may be gained by having the iron peg guarded, as represented *figs.* 29 and 30, which will remove the objection to its being in any way dangerous; and while it facilitates the opening of the gate with one hand, it throws a fresh difficulty in the way of cattle."

He says, that "the iron peg latch would not how-

ever answer for the swing-gate, and he has supplied its place by the jointed latch A, in *fig.* 5, the principle of which is not uncommon, the part O forms a most complete guard to the latch, and the handle being a semicircular ring rests upon the upper bar of the gate, or upon the second bar, making it extremely improbable, that a cow or horse could ever lift up a latch of this kind."

It is added, that "for a swing-gate the latch should be placed as nearly as possible to the middle part of the head, that the gate may the better resist the jar of its shutting; for the sudden check, which the drop catches give to a swing-gate, is greater than what is found in ordinary fastenings; and if the latch were placed towards the top of the head of the gate, it would be as destructive as the common manner of hanging single gates."

He says, that "having finished his drop catches, a friend assured him, that he had seen both single and double catches in Suffolk upon the same principle, and at his request, he procured him a very good sketch of them, and also a sort of model: as far as he could judge from the drawings of the Suffolk catches, they seemed rather to have the advantage of those which he had first seen in Shropshire." But, "in the course of an extensive tour he made last spring, he took occasion to observe, that however generally good methods of hanging and fastening gates might be understood, they were very rarely practised; and he cannot help particularly noticing the gates across the public roads in Dorsetshire, which are very numerous, in support of his assertion: and should these hints ever find their way so far, he hopes that public as well as private conveni-ence, in such respect, may thereby be promoted."

It is added, that "he saw a catch, similar to *fig.* 31, in Devonshire, and the latch used with it was a kind of iron peg nailed to the inner side of the top rail of the gate; but there is an objection, he says, to any catch receiving the latch above the pivot upon which the catch turns: such a fastening, if the gate sinks but very little, will, however, he says, gradually become useless, which gives an undoubted preference to the other drop catches; as with them a gate must sink two inches (which one that is well hung never ought to do) before the catch will cease to act."

And, he thinks, "it is very material that the iron peg should not rest close against the gate-post, as that would very much encrease the difficulty complained of in opening a gate with these fastenings; the middle part of the head of the gate, as to its thickness, is the fittest to receive the iron peg, whether it is to be placed high or low, and the play of the catch will be the same in all instances, provided its shouldering is adapted accordingly."

It is stated, that "the double catch *fig.* 32. is used at this time in several parts of Shropshire, with the latch adjoining it made to rise upon a pivot. The hollow part of the latch is in shape and size like a table-spoon, with a hole drilled through it to prevent rain lodging there; a swing-gate with this fastening is opened either by the hand pressing down the hollow part of the latch, or on horseback you may put a stick, or the butt end of a whip into it, and with only one exertion the gate may be thrown open: on the return of the gate, the latch strikes against the lower part of one of the catches, either of which will rise upon its respective pivot, till obstructed by an iron pin or stud, placed near the centre of the iron-work. These drop catches are thinner at their upper parts than they are downwards, which assists the latch in rising clear of them; and when the gate is fastened, the latch is at rest between the two drop catches. This is not a very easy fastening to describe, and it might be proper to be more particular were it not for the preference due to other contrivances." He adds, that "a guard must be adapted for such a latch, or cattle would be likely to open it; but this fastening is particularly liable to be out of order, either by the sinking or the contraction of the gate: every objection might be more easily removed than the effects of the gate's sinking, and to this he has made a slight improvement, as in the figure; that is, when the latch has sunk lower than the catches, it will strike against an inclined plane, and have a chance of rising upon its pivot to overcome the obstacle. But he has lately, he says, received a catch for a gate, from Leicestershire, which though it possesses a great likeness to *fig.* 27. has one material advantage; that is, that it confines the latch when the gate is at rest, by a full inch and a half within a narrower compass, or allows it so much less play, which was very desirable. This pattern of a single catch admitted of a small improvement, and it was easily adapted also to a double catch: with respect to their use, what has been said in regard to *fig.* 27. and *figs.* 25 and 26, will properly apply to these catches. The single catch is represented at *fig.* 33, and the double catches at *figs.* 34 and 35, which are entitled to a most decided preference, compared with any that he has ever met with. Besides the handle of the single catch rises almost perpendicularly, and therefore does not interfere with the hand in performing its double office of opening the gate, and holding up the catch at the same instant: whereas the handle of the catch *fig.* 27. must be brought much forwarder in lifting it up, than that of the catch *fig.* 33. and this, added to the difference in the play of the gate, will make altogether about three inches, which is a great deal in the span of a hand." But, he observes, that "there is an objection which attaches equally to these kind of catches, as to others, that they may easily be broken off a post, and carried away; and to obviate this, he confesses himself incompetent to advise any certain mode of securing them; but he submits that where such depredations have been experienced, there will ingenuity most likely be found to counteract them."

He suggests, that he has "often met with a sort of puzzle chain, *fig.* 36. that might be used advantageously, but, he asks, why not prefer a padlock in such cases?"

It is further stated, that "there are many inventions of spring catches and latches, the common sorts

of which are very liable to be out of repair, by being constantly exposed to the weather; and that those of a superior kind are too expensive for general purposes."

At *fig.* 37. "is a hook and ring for holding a horse by the bridle or halter, and though very generally known and adopted, it cannot be too strongly recommended: a stable-yard should, he says, be well furnished with such hooks, to prevent the use of common nails, which are extremely dangerous; and one of them may occasionally become an useful appendage to a gate or wicket. And *fig.* 38. is a hasp with a hook rivetted to it, useful for fold-yard gates, pig-sties, dog-kennels, and such-like" places.

It is remarked by Mr. Parker, in respect to cast-iron work for fastening and hanging gates, in the fifth volume of the Farmer's Magazine, "that not a single instance of failure has come within his knowledge, in this sort of iron work for gates, as recommended below, which has been purposely submitted to the most severe tests; and he has little doubt but that, in a reasonable time, the improvement will be generally adopted."

And he adds, that "Messrs. Deerman, Francis, and Company, Eagle Foundery, Birmingham, have undertaken to supply the public with the castings, completely finished and fitted, at $3\frac{1}{4}d.$ per *lb.* Two tons of which are ordered to be cast without delay, and several hundred weights of the castings have already been brought into use, under his immediate direction." And he offers "a few memorandums, with a view to furnish a distinct method of giving orders for the cast-iron work, to those gentlemen who may wish to try it. For the gate *fig.* 5, to which a head-strap and strap-thimble are adapted, of cast-iron, omitting the intermediate length of the 9 feet iron strap."

For "Mr. Parker's patterns, Nos. 1, 3, 4, 6, 7, 8, and 9 (the castings being embossed with numbers from 1 to 16), $17\frac{1}{2}lb.$ $5s.$ $7\frac{1}{4}d.$"

A pair of sheet-iron escutcheons, $2d.$

No. 9 is the jointed latch, in three pieces: 12 two inch wood screws, 4 one and a half inch ditto, and 16 twopenny clout nails, will be wanting for the above.

For a common ready-made gate, having a strong top-rail for the strap-thimble, Nos. 1, 3, 4, 5, 6, and 7, $15lb.$ $4s.$ $8\frac{1}{4}d.$

Twelve two inch screws, and two one and a half inch ditto.

For a common gate, not having a strong top-rail for the strap-thimble, Nos. 1, 2, 3, 4, 5, and 6, $13lb.$ $4s.$ $0\frac{3}{4}d.$

A complete set of specimens, being 16 in number, which form sets for every purpose, including swing-gates, $41lb.$ $12s.$ $9\frac{1}{4}d.$

He adds, that "the shapes of the several pieces of cast-iron work will point out the manner in which they are respectively to be attached to gates, and for ordinary purposes."

It is observed, that "the cast-iron fastenings are found to resist the strongest horse purposely rode against the gate; and the stoutest man may throw the gate towards its falling-post, with all his power, without injury to the cast hangings." And that "the saving to the public, by adopting the cast-iron, compared with the best wrought-iron work, is, he says, apparently more than 60, and really no less than 50 per cent." He concludes, by stating, that "the patterns have been executed with much exactness, in fine mahogany, to his utmost satisfaction, and the castings are of course the same. It therefore remained only for their strength to be proved; and this being done, his design is complete." But "should the cast-iron work, in any case, happen to be furnished from the foundery, without being accurately fitted, it may be adjusted by filing, with the same facility as wrought-iron work may be altered."

GATEWAY, a passage or opening into inclosed grounds, in which a gate is fixed.

GATHERING, provincially rolling corn-swaths into a sort of cocks or bundles.

GAUN, provincially a gallon measure; also a small tub.

GAUNT-*Bellyed*, in *farriery*, a term applied to such horses or other animals as are light and thin in the carcase, or whose bellies shrink and are drawn up towards their flanks. Horses of this shape are supposed to be washy, tender, unhealthy, and not capable of much hard labour.

In order to the cure of this, it may be observed, that though little can probably be effected by any means that may be attempted, such animals should be fed as little as possible with dry food.

GAVEL, a provincial term implying a row or swath of corn, that has been cut down with the scythe. It is also a word signifying ground.

GAVEL-*Kind*, a custom whereby the lands of the father are equally divided at his death among all his sons.

GAVELOCK, an iron-bar for entering stakes into the ground. It should be of a sufficient thickness to prevent its being bent in using, and have a claw at the contrary end, for the purpose of drawing nails, or other similar uses.

GAY, a term signifying speckled or light coloured cattle.

GEAVLE, provincially the upright end of a house.

GEERING, a term provincially applied to the ladders and side-rails of a waggon.

GEERS, a term applied to the harness of draught or team-horses.

GEESE. See *Goose.*

GELDING, the act of castrating an animal. In performing this operation, attention should be paid to the age, and also the season of the year. If it be a colt, he may be gelded at nine or fifteen days old, if the testicles be come down; as the sooner this is done, the better, for the recovery and growth of the animal; but horses may be gelded at any age, provided sufficient care be taken.

The most proper seasons are either the early spring months, or those of the autumn.

The manner of proceeding, whether it be for a foal or stone-horse, after being cast upon some soft place, is to take the testicles between the foremost and great finger, then to slit the scrotum or cod, and press them forth; when this is done, with the fingers, or a pair of small nippers made of steel, box, or brazil wood, to fix the cords of the testicles, so as to cut the testicles away, securing the vessels by means of a strong waxed thread or ligature; or in the old method, which should never be practised if it can be avoided, to cut them off by a knife, or thin cauterizing iron, made red-hot. In the first method, it will only be necessary to simply keep the sides of the cod in union; but in the latter, a plaster of rosin, wax, and turpentine, well dissolved together, is generally melted upon the parts with the hot iron. Under this treatment the animal should be kept loose in a warm stable, that he may walk up and down, as moderate exercise is highly necessary.

When the operation is attended with much inflammation, blood must be taken away; and where the belly or sheath swells, fomentations of the discutient kind should be applied twice a day.

Gelding, in *horsemanship*, a term applied to a castrated animal of the horse kind. Horses are generally so called, until they are about three years old.

GELT-GIMMER, a term implying a barren ewe.

GEOFF, a provincial word, signifying a mow of hay or corn. See *Stack*.

GERMINATION, the act of sprouting or shooting forth. See *Vegetation*.

GERMINS, buds, or tender shoots.

GIB, a hook, or a hooked stick, as nut-gib, &c.

GID, in *farriery*, a disease in sheep, and some other animals, it is a sort of vertigo which affects the head. It is supposed by some to be a species of *hydrocephalus*, or an encysted collection of water in the head, betwixt the dura and the pia mater, which is constantly accompanied with a continual turning about. And by others it is said to arise from a worm or maggot under the horn, on either side, and that the turning round is the effect of this worm or maggot. And Mr. Collins has heard of cows being also giddy, and that a perforation has been made near the horn, the worm or maggot taken out, and the animal cured.

According to some farmers, this complaint is more common to sheep that are too richly fed, and they often term it the *sturdy evil*. The cure is attempted, after bleeding to about three quarters of a pint, by the following remedy:

Take of assa-fœtida, an ounce; dissolve it in a quart of water, and add juice of garlick, four spoonfuls; honey, two ounces.

Give a quarter of a pint once in three hours, till half is taken; then the rest at equal doses, night and morning.

And the sheep, when put into hilly pasture-grounds, are said to be less liable to relapse. See *Sheep*

In Lincolnshire, where it is known by the name of sturdy, or *bladder* on the brain, there is a person who trepans for it, and saves as many as he loses. He raises the skin with a sharp strong hooked knife over the spot affected, about the size of a crown-piece; he then raises nearly the same size of the skull-bone, letting the piece hang as by a hinge on one side; then with a quill, cut slanting to a point, like a spear, and hacked on each side, he fishes in for the bladder, and brings it out whole, putting down the bone again, and covering with a plaster. And it is observed by Mr. Parkinson, that pulling sheep violently by the ears, and then cutting them off, in these cases, has effected a cure. Among the South Down flock-farmers-sheep, in this situation, are said to be *Paterish*.

GIDDY, another term used for the same disease.

GIFT-DAY, a term signifying a boon day, or a day's work given from neighbour to neighbour.

GIGGS, in *farriery*, small bladders, or swellings, sometimes taking place on the inside of the lips and palates of horses. They are to be cured by slitting them open with a knife, or lancet, and afterwards washing them with a weak solution of borax. But when they degenerate into what are called *cankers*, which are known by little white specks that spread into irregular ulcers, the best method is to touch them with a small flat cautery, till the spreading is stopped, and to rub the sores three or four times a-day with ægyptiacum and tincture of myrrh. When, by this dressing, the sloughs are separated, they may be washed with a sponge dipped in alum, green vitriol, or sublimate water, if they continue to spread; or with a tincture made by dissolving half an ounce of alum, and two ounces of honey, in a pint of tincture of roses. Either of these will cure them, and they ar every useful in most disorders of the mouths of these animals. It is sometimes written *Gigs*, and also *Flaps*.

GILDERS, hair nooses for catching birds, &c.

GILL, provincially a pair of timber-wheels.

Gill, a small valley, connected with a small stream and some woodiness. Also a rivulet, or small brook. It is likewise a name given to ground-ivy, in some districts.

GILTS, a provincial term applied to young female pigs, whether open or spayed.

GIMMER, a female young sheep.

Gimmer-*Hog*, a female sheep of the first year.

Gimmer-*Lamb*, an ewe-lamb.

GIN, a spirituous liquor distilled from the berries of the juniper tree. It is said to be a custom with some farmers, who fatten much veal, to give the calves little balls of barley-meal dipped in or made up with this liquor, which experience has shown to fatten them much sooner than when they are not employed. The reason of this is probably by their disposing them more to sleep.

GIRLE, a term applied to a roe-buck of two years old. It is sometimes written *Gyrle*.

GIRTHS *of a Saddle*, in *horsemanship*, the strong web, or canvas straps, which, being buckled under a horse's belly, serve to fix the saddle. It is a common error to girth a horse too strongly, not only when he is to be mounted, but even when standing clothed in the stable. Mr. Clark reprobates this practice very much, in his account of the management of sick horses. See *Saddle*.

GLADDON, a provincial term applied to the large and small cats-tail grass.

GLANDERS, in *farriery*, an obstinate and troublesome disease incident to horses, in which a slimy, mucous, or purulent matter is discharged from the nostrils.

This, according to the authority of La Fosse, is either white, yellow, or greenish, sometimes streaked or tinged with blood: when the disease is of long standing, and the bones are diseased, the matter turns blackish and becomes very fœtid, and is always attended with a swelling of the kernels or glands under the jaws; in every other respect the horse is generally healthy and sound, till the distemper has been of some continuance.

It is remarked by St. Bel, that the symptoms that characterise this disease, and distinguish it from the strangles, and others of a similar kind, are, that the virus in most cases does not produce in the beginning any sensible alteration in the animal œconomy; that the horse taken with it has neither fever, dulness, nor distaste to food; the appetite is good, the digestion easy, and the secretions regular; and that it is this apparent state of health which in part confirms the existence of the glanders, when it is attended with the discharge from the nostrils only. Further, that the obstruction and insensibility of the sublingual lymphatic glands is a certain token of the virus of the glanders. La Fosse adds, that it is always a bad sign when the matter sticks to the inside of the nostrils, like glue, or stiff paste; when the inside of the nose is raw, and looks of a livid or lead colour; when the matter becomes bloody, and stinks; and when it looks of an ash-colour. But when only a limpid fluid is first discharged, and afterwards a whitish matter, the glands under the jaw not increasing, a speedy cure may be expected; and in this case, which arises from taking cold after a horse has been over-heated, the pituitary membrane is but slightly inflamed, the lymph in the small vessels condensed, and the glands overloaded, but not yet ulcerated.

The observations of Bracken and Gibson also show that they were not absolute strangers to the nature of the disorder.

M. La Fosse, however, after examining the carcasses of glandered horses by dissection, and marking the state of the viscera, affirms the disease to be altogether local; and that the true seat of it is in the pituitary membrane, which lines the partition along the inside of the nose, the maxillary sinuses or cavities of the cheek-bones on each side of the nose, and the frontal sinuses or cavities above the orbits of the eyes; that the internal viscera, as liver, lungs, &c. are in general sound; and, consequently, that the seat of the disorder is not in those parts, as has been maintained by many writers.

On nicely inspecting the heads of horses labouring under the disorder, he asserts that he found the cavities above-mentioned, more or less, filled with a viscous slimy matter, the membrane which lines them and the nostrils inflamed, thickened, and corroded into sordid ulcers, which, in some cases, had eaten into the bones.

He further remarks, that when glandered horses discharge matter from both nostrils, both sides of the membrane and cavities are affected; but that when they run at one nostril only, that side only is found to be distempered. It is also contended, that the sublingual glands, or the kernels situated under the jaw-bone, which are always swelled in this distemper, do not discharge their lymph into the mouth, as in man, but into the nostrils; and that he constantly found their obstruction agreed with the discharge; sometimes, though rarely, he says, he found the bony partition of the nose carious or rotten; but that the spongy bones about this part may suffer from the acrimony of matter long pent up is not at all extraordinary, though the more solid ones escape.

On these grounds, it is proposed to cure the disease by trepanning these cavities, and taking out a piece of bone; by which means the parts affected may be washed with a proper injection, and, in fine, the ulcers deterged, healed, and dried up.

In regard to the cure of the milder kind of this disease, Bartlet observes, that if, after taking cold, a horse should for fifteen or twenty days discharge a limpid fluid or whitish matter from one or both nostrils, the glands under the jaw rather growing harder than diminishing, we may expect it will degenerate into a true glanders. To prevent which, after first bleeding, and treating him as we have directed for a cold, let an emollient injection, prepared with a decoction of linseed, marsh-mallows, elder, chamomile flowers, and honey of roses, or such-like, be thrown up as far as possible with a strong syringe, and repeated three times a day: should the running not lessen or be removed in a fortnight by the use of this injection, a restringent one may now be prepared with the tincture of roses, lime-water, &c. and the nostrils fumigated with the powders of frankincense, mastich, amber, and cinnabar, burnt on an iron heated for that purpose: the fume of which may easily be conveyed through a tube into the nostrils.

Respecting the operation of trepanning, and the doctrine concerning the disease, as suggested by M. de la Fosse, Mr. Taplin not only condemns the former, but likewise his distinction of the disorder into different kinds, considering the various symptoms that appear, as only marking different stages of the same disease. The fact, according to him, appears to be, "that any corrosive matter discharged from the nostrils, and suffered to continue for a length of time, so as to constitute ulceration and corrode the bones, will inevitably degenerate into and constitute the disease generally understood by the appellation of glanders; every stagnant, acrimonious, or putrid matter is possessed of this property, and more particularly when lodged (or by sinuses confined) upon any particular part. Divested of professional trick, chicanery, and deception, this is the incontrovertible explanation; whether proceeding from an ulceration of the lungs, or the inveterate glandular discharges from the head (where the case is of long standing, and the bones carious), they are equally incurable." But notwithstanding this, a case has oc-

cured in the Veterinary College, of a gentleman's coach-horse having been perfectly cured of the glanders by the internal use of calomel, which was persisted in till the mouth was affected, and for some time afterwards. This ought to lead to further trials with the same remedy. And opium might probably be joined with the calomel in many cases, especially those of the more chronic kinds, with great benefit. In some cases of a very inveterate nature and long continuance, recourse might also be had to the use of *hydrargyrus muriatus* (*sublimate*) in small doses, with advantage. At the same time the fumes of emollient aromatic decoctions may be received into the nostrils, or stimulating injections thrown up by a syringe. A strong decoction of guaiacum chips may also be given every day, to a quart or three pints, throughout the cure. After the disease begins to decline, bark, and other tonic remedies of the same class, may be administered with very beneficial effects. The horse should then be turned out to grass, or have green food given him in the stable for a considerable length of time.

GLANDIFEROUS *Trees*, a term applied to such trees as bear mast or acorns. Thus the oak, beech, &c. are called glandiferous trees.

GLEANING, the act of picking up the ears of grain that are left behind after reaping the crop. This is a practice that prevails much more in the southern parts of the island than in those of the north.

It is a custom that is universal and very ancient, though in this country the poor have no right to glean, except by permission of the farmer. It is, however, a practice that is so much sanctioned by custom, that it is scarcely ever broken through or prevented. It much behoves the farmer, in some places, where it is carried on to excess, to make rules for the gleaners, and not suffer them to be broken under any pretence whatever. And its abuse, in many places, is, according to Mr. Young, so great, "as deservedly to be ranked among the farmer's evils: the poor glean among the sheaves, and too often *from* them, in so notorious a manner, that complaints of it are innumerable. Make it, says he, therefore, a law, that no gleaner shall enter a wheat-field until it is quite cleared of the crop: this is the practice in many places, and great advantages are found from it. But, upon this plan, always desist from turning any cattle into the field, until the poor have gleaned it; for if a use is made of keeping them out while sheaves are there, merely for an opportunity of turning hogs and other cattle in, it is double-dealing, and a meanness unpardonable." It is a custom, we are afraid, that answers no good purpose; but which often leads to immorality, idleness, and a looseness of character.

GLEBE, in its proper acceptation, signifies the soil or ground in general; but it is particularly applied to the land possessed as part of the revenue of an ecclesiastical benefice.

GLEBOUS, a term provincially used for turfy.

GLEDE, a term applied to a kite, or bird of prey.

GLEN, a valley or dale between hills.

GLOR-*Fat*, a term signifying very fat.

GLUME, in *vegetation*, is a kind of cup, consisting of two or three membranous valves, which are often pellucid at their edges. It is a sort of cup belonging to the grasses.

GLUT, provincially a large wooden wedge.

GLUTEN, a constituent part of most farinaceous substances. It abounds the most in the meal of wheat. It is a white greyish tenaceous material, which is insoluble in both water and spirit of wine, and, on boiling with the former, coagulates in a similar manner to that of the white of the egg. As partaking much of an animal nature, it is highly nutricious. In order to ascertain that wheat has not been injured by heating or other means in this principle, it has been advised by Mr. B. G. Sage, in the Journal de Physique for 1794, to make a paste with flour and water, then to wash it with the hands under water, which must be frequently changed, till it no longer becomes discoloured. The substance remaining in the hand is the gluten; and, if the corn be good, it is elastic, and will contract when drawn out; but in the contrary case, or where it has heated, it is brittle; and, where it has undergone the process of fermentation, none of the gluten is procured. It is frequently, from its animalised nature, termed vegeto-animal matter. See *Vegeto-animal Matter*.

Potatoes, and all vegetable substances that nourish in any great degree, have this material in a pretty large proportion.

GLYSTER, in *farriery*, a remedy injected into the rectum of an animal. These are necessary for horses in different disorders, and may be distinguished according to the qualities of the ingredients of which they are composed, into the following kinds; *anodyne*, *nourishing*, *diuretic*, *emollient*, *laxative*, *purgative*, *astringent*, *&c.*

It is observed by Mr. Clark, that, when administered to horses, they are of greater importance in relieving them from many acute complaints than is generally imagined; and it were to be wished that, in place of the more expensive cordial drenches, &c. which are but too frequently given in most of these cases, a simple glyster of warm water, or thin water-gruel, were substituted in their stead; the latter often proving of great benefit, whilst the former too frequently prove hurtful.

Glysters serve not only to evacuate the contents of the intestines, but also to convey very powerful medicines into the system, when perhaps it is not practicable to do it by the mouth: for, although they are only conveyed into the larger intestines, and perhaps hardly penetrate into the smaller, still they are extremely useful, by fomenting as it were the latter, and at the same time by softening the hardened excrement that is accumulated in the former, and rendering it so soft as to be expelled out of the body; by which flatulencies or other offending matters that may be pent up in them are likewise expelled. Besides, by their warmness and relaxing powers, they act as a fomentation to the

bowels: hence they may be of considerable service in removing spasmodic constrictions in the bowels, carrying off flatulencies, and in preventing inflammation in the intestines, &c.; or, by conveying opiates to the parts affected, give speedy relief in colics, &c.

The use of emollient glysters in fevers is considerable. They act by revulsion, and relieve the head when too much affected. Besides, by throwing in a quantity of diluting liquor into the intestines, it not only relaxes and cleanses them, but may be said to cool the body in general; at the same time, a considerable portion of the liquid is absorbed and conveyed into the mass of blood, by which means it is diluted; and, in particular complaints in the bowels, glysters give almost immediate relief, as the remedies, when judiciously prescribed, pass immediately to the parts affected, with little or no alteration from the powers of the body.

Nor is the use of glysters confined to medicines only: food and nourishment may be conveyed into the system in this way, when a horse is unable to swallow any thing by the mouth. Horses have frequently been supported for several days together by nourishing glysters, made of thick water-gruel, during violent inflammations or tumors in the throat, till such time as they have been discussed or suppurated.

Nor will these effects appear strange to those who have an acquaintance with the anatomical structure of the body. For the sake of those who have not, it may just be sufficient to observe, that certain vessels called lacteals, whose mouths open into the inner cavity of the intestines, absorb or drink up the chyle or nourishment that is produced from the food, and convey it into the mass of blood. The same process takes place when nourishment is conveyed into the intestines by the anus or fundament: only the food requires to be so far prepared, broken down, and diluted with water, as to render it fit to be absorbed by the vessels mentioned above.

In administering glysters, it ought always to be observed, that the contents of the glyster be neither too hot nor too cold, as either of these extremes will surprise the horse, and cause him to eject or throw it out before it has had time to have any effect. Previous to introducing the glyster-pipe, the operator, after anointing his hand and arm with oil, butter, or hog's-lard (observing, at the same time, that the nails of his fingers are short), may introduce it into the rectum, and draw out the hardened dung gradually. This operation, in farriery, is termed *back-rakeing*; and becomes the more necessary, as it frequently happens that a great quantity of hardened dung is, in some cases, collected in the rectum, and which the horse cannot void easily without assistance of this kind.

The composition of glysters should be extremely simple: on that account they will be easily prepared, and as easily administered, provided the operator is furnished with a suitable instrument for the purpose. The generality of glyster-pipes that are used are by far too small and too short: although it may appear a kind of paradox, yet it is a fact, that a glyster-pipe of a larger size than the ordinary ones, and of a proper thickness, is much easier introduced into the anus than one that is considerably smaller. It is likewise obvious, that when the pipe is too short, it renders glysters of no use, because it cannot convey the glysters so far up into the intestines as is necessary for them to be retained; a small short pipe of six or eight inches long is not capable of conveying the injection to the end of the rectum, which, in a horse of a middling size, is about sixteen or eighteen inches long.

But further—after the hardened dung is taken out of the rectum by the operation above-mentioned, the bladder being distended and full of urine, it cannot exert its contracting power immediately, so as to expel its contents; it therefore presses up the empty rectum, and forms as it were a kind of tumor in it: if the pipe is too short, it cannot reach beyond this rising in the rectum, which forms as it were a declivity back towards the anus; and hence the liquor regurgitates or flows back at the anus as soon as it is discharged from the pipe.

The smallness of the bag or bladder, which is generally proportioned to that of the pipe, is another very material objection to these instruments, as it seldom contains one quart of liquid; from which circumstance, very little benefit can be derived from the use of them in such large intestines as those of a horse.

It is further remarked, that large syringes are frequently used for the purpose of giving glysters; but of all the instruments ever invented, they seem the most improper for horses. The shortness and smallness of their ivory pipes are not only a material objection against the use of them, but they are apt to tear and wound the gut; for, if a horse should prove restless, either from pain, as in cases of the gripes, or from viciousness, the syringe and pipe being quite inflexible, in the struggle to throw up the injection the gut may be wounded or hurt, by which a discharge of blood and other bad consequences may follow. But even if there was not the least chance of their hurting the horse or wounding the gut, yet the force with which they throw up the liquor, always causes a surprise, of course a resistance, attended with a vigorous effort to throw it out; which indeed frequently happens before the pipe of the syringe is withdrawn, and frequently upon the operator.

The most proper instrument for the giving of glysters is a simple bag or ox-bladder, which will hold two or three quarts, tied to the end of a wooden pipe about fourteen or fifteen inches long, one inch and a half diameter where the bag is tied, and of a gradual taper to the extremity, where the thickness should suddenly increase, and be rounded off at the point, and made as smooth as possible: the perforation or hole through the pipe may be made sufficiently large, so as to admit the end of a common funnel, for pouring in the liquor into the bag. By the flexibility of the bladder at the end of this instru-

ment, no danger can happen to the horse; the glyster is conveyed so far up into the intestines that it will be retained; it causes no surprise (provided the liquor be neither too hot nor too cold, but milk-warm), as no other force is required to throw it up than the holding the bag a little higher than the level of the pipe; by which means the liquor flows gently into the gut, without any surprise to the horse. After using the bag, it may be blown full of wind, a cork put into the pipe, and hung up in some dry place to prevent it from rotting; by which means it will last a considerable time.

As a more general use of these remedies, in the practice of farriery, would be attended with the most salutary effects, especially in acute diseases, where the speediest assistance is necessary, we shall here subjoin some few formulæ for composing them, together with the cases in which they may be administered with advantage.

ANODYNE GLYSTER.

Take of the jelly of starch, or infusion of linseed, one pint; liquid laudanum, one ounce, or about two table-spoonfuls.

When there is reason to apprehend inflammation in the bowels, solid opium may be given in place of laudanum, from twenty to thirty grains, in proportion to the urgency of the symptoms; it ought to be well triturated or rubbed in a mortar, with a little of the liquid, till it is thoroughly dissolved. The smallness of the quantity of liquid here recommended gives it the better chance of being the longer retained, as the good effects to be derived from the opium depend entirely on this circumstance. This glyster is proper to be given in violent gripings, attended with purging, in order to blunt the sharpness of the corroding humours, and to allay the pain usually attending in such cases. The starch will in some measure supply the deficiency of the natural mucus, or covering of the intestines, which has been carried off by violent purging. It may be repeated, if the symptoms continue violent, only diminishing the quantity of laudanum or of the opium.

ASTRINGENT GLYSTER.

Take of pomegranate-bark, or oak-bark, two ounces; red rose-leaves, fresh or dry, a handful; balustines, an ounce: boil these in two quarts of water, till one is nearly consumed; then pour it off, and dissolve it in four ounces of diascordium; to which may be added a pint of port-wine.

This will answer all common cases, where restringents are necessary, but should never be given in larger quantities; for the longer glysters of this kind lie in the bowels, the more efficacious they are.

DIURETIC GLYSTER.

Take of Venice turpentine, two ounces; Castile soap, one ounce. Dissolve the soap in two quarts of warm water; then add the turpentine, after it has been well beaten up with the yolks of two eggs.

The diuretic glyster is of great use in the strangury, and obstructions in the urinary passages; and as it is immediately applied to the parts affected, it seldom fails of giving relief, and has a much better effect when prescribed in this manner than when given by the mouth; by this last way it mixes with the whole mass or fluids, and may lose a considerable portion of its diuretic quality before it reaches the kidnies; but, by being administered in the form of a glyster, it is readily absorbed by the neighbouring vessels, and promotes a free discharge of urine.

EMOLLIENT GLYSTER.

Take two or three quarts of thin water-gruel; salad-oil and coarse sugar, of each six ounces. Dissolve the sugar in the water-gruel, then add the salad-oil. Give it milk-warm. Or,

Take marshmallows and chamomile-flowers, each a large handful; bay-berries and sweet fennel-seeds bruised, each an ounce; boil in a gallon of water to three quarts, pour off into a pan, and dissolve in it half a pound of treacle, and a pint of linseed-oil, or any common oil.

LAXATIVE GLYSTER.

Take two or three quarts of thin water-gruel, Glauber's salts, eight ounces; salad-oil, six ounces.

When Glauber's salts are not at hand, common salt may be used in its stead.

A great variety of receipts might be added for making glysters, composed of the infusion of different herbs, seeds, &c. But the above ingredients are always easily got; and they will be found to answer all the intentions required under this head, which is to soften the hardened excrements, to lubricate the intestines, and, by exciting a gentle stimulus, promote a free discharge of their contents; which, when once obtained, seldom fails of giving relief in inflammatory cases, spasms, &c. Or,

Take two or three handfuls of marshmallows; senna, one ounce; bitter-apples, half an ounce; bay-berries, and aniseeds bruised, each an ounce; salt of tartar, half an ounce: boil them a quarter of an hour in three quarts of water, pour off the liquor, and add four ounces of syrup of buckthorn, and half a pint of oil.

This glyster will purge a horse pretty briskly; and may be given successfully, when an immediate discharge is wanting; especially in some fevers with inflamed lungs, or other disorders which require speedy relief.

But it is necessary to caution against a solution of coarse aloes for this purpose, as it has been found to gripe horses violently, and excite feverish and sometimes convulsive symptoms; and indeed all pungent and stimulating medicines, as the stronger purgatives generally are, should be given in this form with great caution.

NOURISHING GLYSTER.

Take of thick water-gruel, three quarts.

When glysters of this kind are found necessary,

they may be given four or five times in the day, according as circumstances may require: they are of considerable service in cases where the horse cannot eat sufficiently to support him, or swallow any thing, from inflammation of the throat, jaws, &c. or in convulsions, attended with a locked jaw, &c.

PURGING GLYSTER.

Take two ounces of senna; of boiling water, two quarts: infuse the same and strain it off; then add syrup of buckthorn and common oil, of each four ounces.

This glyster will operate more briskly than the former, and on that account may be preferred when an immediate or speedy discharge is necessary.

There are a variety of cases where glysters may be administered with great success, besides those already hinted at; as in inflammatory fevers; spasmodic constrictions, and colicky complaints in the bowels; in recent coughs, apoplexy, convulsions, paralytic complaints, or swelling of the belly, whether from air pent up in the bowels or from hardened excrements; in cases where horses are troubled with worms, as the ascarides, which lodge in the lower part of the intestines, or when bott-worms are observed sticking in the anus, or voided with the dung; in very costive habits, before laxative or opening medicines are given by the mouth; in wounds which penetrate deep into the muscular or tendinous parts, or in the belly, &c.; in inflammations of the eyes, or when the head seems particularly affected; in inflammatory swellings on any part of the body; when a horse cannot swallow any food, &c. whether it proceeds from spasm in the muscles of the throat, inflammations, or swellings. Glysters composed of mucilaginous substances, as starch, linseed, &c. are of great benefit in violent diarrhœas or looseness, whether it proceeds from a natural discharge, or from too strong purging medicines.

It ought always to be remembered, that glysters should be repeated frequently, till such time as the disorder for which they are given is either removed or greatly abated. This injunction may be the more readily complied with, as the administering glysters to horses is not attended either with much trouble or disturbance to them.

GNATS, small troublesome insects, met with in large quantities near watery places; and which are said to destroy the leaves of some tender vegetables as soon as they appear, especially turnips.

GOAD, a pointed instrument with which oxen are driven when employed in teams. It is often also a sort of whip formed by a leather thong attached to it.

GOAR-VETCH, the same with summer-vetch. See *Vetch.*

GOAT, a genus of animals, the characters of which, according to Mr. Ray, are, that it is covered with hair, not with wool; that its horns are less crooked than those of a sheep, and that it has a beard hanging down from its chin, and is of a strong smell. There are several species of this genus of quadrupeds.

It is observed by Mr. Mills, in his Treatise on Cattle, that the goat is an animal of more sagacity than the sheep. Instead of having an antipathy to mankind, they voluntarily mix with them, and are easily tamed. Even in their original state they shew no ferocity of disposition. These animals, continues he, are sensible of caresses, and capable of a considerable degree of friendship. They are stronger, more agile, and less timid, than sheep. They have a lively, capricious, and wandering disposition; are fond of high and solitary places, and frequently sleep upon the very points of rocks. They are more easily supported than any other animal of the same size; for there is hardly an herb, or the bark of a tree, which they will not eat. Neither are they liable to so many diseases as sheep; they can bear heat and cold with less inconvenience. The actions and movements of animals depend more upon the force and variety of their sensations than the structure of their bodies; the natural inconsistency or fancifulness of goats is accordingly expressed by the irregularity of their actions: they walk, stop short, run, jump, show and hide themselves, as it were by mere caprice, and without any other cause than what arises from the natural vivacity of their temper.

The buck will copulate when he is a year old, and the female when she is seven months. But as this is rather premature, they are generally restrained till after eighteen months or two years. The buck is bold, beautiful, and vigorous; and one is sufficient to serve 150 females. The females are generally in season from September to the end of November. At that time the males drive whole flocks of the females continually from place to place, and fill the whole atmosphere around them with their strong disagreeab odour; to which, as resembling assafœtida, some good effects are attributed, in the prevention of nervous and hysterical affections. Horses are also supposed to be much refreshed by it; on which account many people keep he-goats in their stables.

Goats go with young four months and a half, and bring forth from the latter end of February to the latter end of April. Having only two teats, they generally bring forth but one or two young; sometimes three; and in good warm pastures there have been instances, though rare, of their bringing forth four at a time. They continue fruitful till they are seven years of age; but a buck-goat is seldom kept after he is five. Both young and old are affected by the weather; a rainy season making them thin, a dry sunny one fat and blithe. Their excessive venery prevents their longevity; for in our climate they seldom live above eleven or twelve years.

These animals may be of great advantage to the farmers in some parts of the kingdom, as they will live in rocky barren countries, where nothing else can get a support for life. They will climb the steepest rocks, and there browse upon briers, heath, and shrubs of various kinds which other creatures will not taste of. They will feed on grass in pastures; but, as they love browsing on trees much better, great care should be taken to keep them from valuable plantations.

The greatest advantage of these creatures is their

milk, which they yield in large quantities, and which is accounted the best milk of all animals. They mix this and cows milk together in many parts of the kingdom, and a very valuable cheese is made from it. Besides this, the kids or young goats are very fine food, and the best kinds bring forth these two or three at a time, and that twice a year.

Goats hair is also valuable; it may be sheared as the wool from sheep, and is excellent for making ropes that are to be used in the water, as they will last a great while longer than those made in the common way. A sort of stuff is also made of it in some places.

The suet of the goat is also in great esteem, and many of the inhabitants of Caernarvonshire kill them merely for the sake of their fat, which makes candles of a superior quality to the common. Of their horns excellent handles are made for tucks and pen-knives. The skin is peculiarly well adapted for the glove manufactory, especially that of the kid; as it takes a dye better than any other skin. The old skin is also of great use, being preferred to that of the sheep, and the flesh affords a cheap and plentiful provision in the winter months, particularly when the kids are brought to market. The haunches of the goat are frequently salted and dried, and supply all the uses of bacon: this by the Welsh is called *coch yrwden*, or hung venison.

The kind of goats for keeping to advantage should be chosen in this manner: the male should have a large body, his hair should be long, and his legs straight and stiff; the neck should be plain and short, the head small and slender, the horns large, the eyes prominent, and the beard long. The female should have a large udder, with large teats, and no horns, or very small ones. They should be kept in flocks, that they may not straggle; and they should have good shelter both in summer and in winter, the heat and cold being both prejudicial to them. They should be coupled in December. They should have no litter in winter, but only a paved floor kept clean. The kids are to be brought up for the table in the same manner as our lambs are. They are recommended by some to be kept among horses, for the reasons mentioned above.

GOD'S-GOOD, a term provincially employed to signify yeast or barm. See *Yeast*.

GOFFE, the same with geoff. See *Geoff*.

GOGGLES, in *farriery*, a disease in sheep, which is sometimes very destructive. It first shows itself, according to a writer in the Bath Papers, by the ears of the sheep dropping, and their rubbing their tails much more than other sheep. It is not supposed to have any affinity to giddiness, as the sheep do not run round. It has the most resemblance to the staggars in lambs, but differs in this respect, that the staggary lambs show weakness before and fall forward, whereas goggly sheep show weakness behind, and, when forced to run, fall backwards. The sheep under this disease continue to get poorer and weaker, till they cannot drag their limbs after them, and ultimately die. It is supposed by some to be an affection of the paralytic kind, and that of course the seat of the disease is in the spinal marrow. It was formerly either unknown or unnoticed by sheep-farmers. No satisfactory method of cure has hitherto been proposed; but warmth and a change of pasture have been supposed useful.

GOING, in *horsemanship*, the pace or gait of a horse. See *Canter*, *Gallop*, &c.

GOOL, a term applied to a ditch in some districts.

GOOSE, a well-known bird of the web-footed kind, which may in many situations, as near large commons, and where there is plenty of water, be reared with advantage by the farmer, being highly valuable for its flesh, fat, and feathers. There are several sorts of geese; but the large common kinds are the most suitable for the purposes of the farmer. See *Poultry*.

Goose-*Grass*, the name of a troublesome weed very frequent in clay grounds. It is sometimes named *wild-tansy*. The best method of destroying it is to mow it in summer, well dung the land, and never plough it out of heart.

GOOSEBERRY, a plant of the shrubby fruit-bearing kind. It has been lately proposed to introduce a sort known by the title of Ironmonger for the purpose of a hedge-fence.

Gooseberry-*Caterpillar*, a very destructive insect to these, as well as other sorts of plants. Various modes of destroying it have been proposed, as by fumigation, &c. See *Caterpillar*.

GORGED, in *farriery*, a term denoting any diffused swelling. It is apt to affect the horse's pastern joint and legs. It also signifies the being hoven as cattle, by fresh green luxuriant food.

GOSS, a term provincially applied to the whin. It is sometimes written *gorse*. See *Furze*.

GOUD, a term applied to the corn-marigold in some places.

GOULANS, a provincial word used to signify corn-marigolds.

GOURDINESS, in *horsemanship*, the dealer's term for a swelling or thickness of the ligaments in a horse's leg.

GOURDY-LEGS, in *farriery*, a distemper in horses, caused by painful and other fleshy sores.

The way to cure them, is first to shave away the hair upon and about the sore places, as close as may be, and then to anoint them with linseed-oil and aqua vitæ, shaken together till they are perfectly mixt; renewing the mixing of them as often as there is occasion to use them, because they separate by standing, without being shaken; anoint the sore places with the liquid every day till it is perfectly healed.

GRAFTING, the operation of raising fruit-trees by the insertion of the small tender branches of one kind into stocks of another. There are many different methods of performing this sort of business; but they properly belong to gardening. See *Orchard*.

GRAIN, a general name for all sorts of corn, as wheat, barley, oats, rye, &c.

It is observed, by the author of Modern Agriculture, that a great proportion of the threshed grain in the possession of the farmer is kept in the chaff on the barn-floors; or, after being cleaned and put into sacks, is placed in that state, either in the barn, or

in some house appropriated for the purpose, till it be sent to market. Neither of these last methods of keeping grain can, he thinks, be approved of, as on low damp floors it must soon become musty, notwithstanding any precautions that can be used to prevent it. But the tenantry in Caithness, in Scotland, and some of the neighbouring districts, he is informed, use a very uncommon mode of preserving their grain. They twist straw into large ropes, which they coil up in the same manner as sailors do ships' cables; and within these coils the grain, when threshed and freed from the chaff, is deposited. This is, however, a troublesome, and by no means a good plan, as much loss as well as injury must often be sustained by it.

In order to preserve grain in a proper condition, after being threshed out, it should always, as soon as possible, be well cleaned from the chaff in dry weather, and put into a bin, chest, or room, that is perfectly free from damp, until it can be deposited in the granary, or sent to the market, which ought to be done as soon as the convenience of the farmer will admit. By delaying the cleaning of the grain, the sample is often greatly injured. In the execution of the business, different modes are in practice; but where threshing-machines are in use, it is mostly performed by them. Winnowing-machines are also often employed for the same purpose. But, in particular districts, the *casting* shovel and spry, or flat broom, is had recourse to, the latter serving to remove the chaffy parts and the minute particles of straw that are separated by the wind from the grain. It is a method that may be made use of with advantage where there is plenty of room, but, under other circumstances, the winnowing-machine is more proper and beneficial. The cleaning of grain by the wind on the barn-floor, is very imperfect, tedious, and troublesome. When the grain has been thus cleaned, it should, especially in the wheat and barley kinds, be passed through a screen, which, in most of the improved winnowing and threshing-machines, is provided for the purpose.

In this way, all the small seeds of weeds and other kinds, as well as other foreign matters, are separated from the corn. And where these grains are cleaned without these last sorts of winnowing-machines, it will of course be requisite to let them through a corn-screen afterwards, in order to remove any small seeds they may contain, as well as the ova of different sorts of insects, by which the production of the weevil, moth, beetle, &c. is prevented; and the depredations which they commit, while in their vermicular state, on different sorts of grain, effectually obviated. Implements of this nature may be had separately, but the business is much more conveniently and cheaply executed at once by such machines as have them attached to them.

It has been observed, that "as the prevention of all sorts of corn from being affected by the different causes that have a tendency to injure it, when laid up for the purpose of keeping, depends upon its being put by in a perfectly dry condition, and on its being afterwards preserved in that situation,—in order to effect these objects in the most perfect manner, it is of the greatest importance to keep the corn, from the first period of its being threshed out of the straw, as much as possible from coming in contact with earth, stone, or other sorts of floors that are placed near to or upon the ground, as they have constantly much disposition to communicate moisture, and by that means greatly injure the grain. And another method is, by preventing the entrance of the atmospheric air as much as can be done, whenever it is in a heavy damp state, by being too much loaded with humidity; as in this way, from the vast extent of surface that is exposed to its influence, it is subject to be very much damaged, the large quantity of moisture thus imparted to the corn bringing on a sort of mouldiness, which is attended with a musty disagreeable smell that lessens its value in a very considerable degree, as well as prevents its keeping."

The means of prevention, "in the first case, is by cautiously avoiding the too common practices of permitting the grain to remain upon the threshing-floors, especially those of the earth or stone kinds, after it has been threshed out, before being cleaned from the chaff; or, after being cleaned, by depositing it upon them either in a loose state or when put up in sacks." And by "the business being performed as much as possible in a dry state of the atmosphere." And in regard to the second, "a great deal may be accomplished by means of proper slides, shutters, or other suitable contrivances being conveniently fixed in the pipes, funnels, or other openings intended for the purpose of ventilation, in the corn-rooms or granaries, which should be kept closely shut up whenever the atmosphere is so much charged with moisture as to prove detrimental to the grain" which is contained in them.

It may be added, that since frequent ventilation, by turning or stirring the grain, is found by experience essentially necessary for preserving and keeping it perfectly sweet and fit for sale, it is obvious, the author of Practical Agriculture says, "on the above principle, that this should only be attempted when the weather is fine, or the air in a dry elastic state. In damp weather, or when frost prevails, it should be excluded as much as possible. Besides air, light is likewise advantageous in the preservation of corn, under similar circumstances, as, without its being admitted, a sort of vegetable mucor, usually denominated mould, is apt to fix upon the grain, and produce much mischief; as it is said, by Dr. Darwin, to possess the same property as that of other funguses, of growing where there is scarcely any change of air, and in situations where there is little or no light, provided there be a suitable degree of warmth and moisture. On the same principle, with the intention of retaining the grain in a state as free as possible from dampness, it might be useful, he thinks, to have well-constructed stoves in the bottom parts of corn-chambers or granaries, for the purpose of occasionally communicating such moderate degrees of heat to the grain, as would be sufficient to dry up and expel any injurious moisture that it might have attracted in damp wet seasons.

On this ground it has indeed long ago been advised, on the basis of experience, by an intelligent writer (Mr. Tull), to preserve wheat by exposing it to the action of a sunshine degree of heat, on a hair-cloth in a malt-kiln, produced by the combustion of clean straw, for such a length of time as may be necessary to remove the dampness; as from four or five to ten or twelve hours, according to the proportion in which it may exist. In this method the heat sheuld always be kept so moderate as not to destroy the vegetative property or life of the grain; as by that means its putrefaction and decay would be prometed. The degrees of heat that would be the most calculated to answer the purpose in different cases would be easily regulated by those instruments that are in common use for measuring the heat and moisture of the atmosphere." These principles, says the first author, "assist us much in reconciling the differences of opinion, that have so long prevailed in respect to the use of air in the preservation of corn in granaries; as they sufficiently show that when admitted in its perfectly dry and elastic state, it must be particularly useful in carrying off any moisture or disagreeable smell that the grain may have contracted by remaining closely heaped together for some length of time; as by the stirring which mostly accompanies the ventilation it must operate in a very extensive manner; but that when applied in its moist heavy state, it must be detrimental in an equal proportion, by imparting its humidity to the corn, and by that means causing it to become musty," from a degree of moisture adhering to it.

It is of course, he thinks, sufficiently obvious, that "the ventilation of grain should be performed when the weather is fine, but never when the air is in a damp condition, or in the time of frost." And that "this is the most completely effected by stirring the corn by proper slides or other contrivances in the floors, windows, and other openings in the granaries or corn-rooms:" but that "it may be accomplished in a more slow and of course in a more uneconomical manner, by shovels, rakes, or other similar tools. But in order that this operation may be more readily as well as more perfectly executed, the grain should never be spread too thickly over the floors of such granaries or store-rooms. From one to two feet or two feet and a half in depth, in proportion as it gets more dry and free from moisture, is, he conceives, fully sufficient for the purpose; as from the natural moisture of the corn when heaped together to too great a thickness at first, it is sometimes apt to take on too much heat, by which the quality or sample is greatly injured." And, he thinks, that "soon after its being deposited, frequent screening should also be practised, and afterwards occasionally, according to circumstances." And that, according to Dr. Darwin, "there are likewise other circumstances to be attended to, by which the due ventilation and preservation of the corn is much influenced, such as those of having the doors, windows, and other principal apertures of the buildings, placed towards the south, and as close to the ceiling as may be, so that the rays of the sun may enter as freely as possible. Besides, the linings of such corn-rooms should always consist of materials that have not a tendency from their coldness to precipitate the moisture from the atmosphere, which is often the case when warm damp south-west winds take place after cold north-east ones, and in that way impart it to the corn that comes in contact with them." It is likewise necessary, he thinks, that "in every case the prevention of the entrance of wet or moisture should be effected by sheltering boards, slides, or other contrivances," so fixed as effectually to answer that purpose.

And it is conceived, that "some management in the turning or stirring of the grain is also requisite, in order that the ventilation may take place in the fullest and most complete manner. When the grain is first deposited, and possesses much natural moisture, it should be much more frequently turned over, than afterwards when it has acquired a greater degree of dryness. Once or twice in every week or ten days may, he supposes, be requisite the first month; afterwards, for four or five months longer, about once ~~in the~~ fortnight may in general be sufficient, and after that period only once in the month, except when the season proves very moist and warm," or in other ways unfavourable for the keeping of the grain.

For the more effectual execution of this intention, it is the practice, "in some places, to have empty spaces left on the sides of the heaps of corn, and other parts, into which they may be turned over when necessary; while in others, square holes are formed in the ends of the floors, and round ones in the middle, by which contrivances the grain is thrown from the upper to the lower chambers, and back again, by which it becomes more perfectly agitated and exposed to the air, a method which is practised in some parts of Kent," with much advantage and success. But as in these modes "such frequent turnings are extremely troublesome and expensive in being executed by the shovel, sliding shutters have been contrived in the middle of the different floors, which have an inclination towards the centre of the granaries, by the occasional removal of which, and the opening of the windows and ventilators, the grain is turned and ventilated at the same time with great facility and convenience. Monsieur du Hamel has found this mode of preserving grain to answer extremely well, even in cases where it was laid up in a moist and damp condition."

It is, however, well known, that "grain may be preserved without having recourse to the practice of ventilation, by having it deposited, when in a perfectly dry state, in such dry deep wells, pits, or other situations, below the surface of the ground, as that it cannot be affected by heat, or the changes that take place in the seasons; however, although corn has been known to have been preserved in this manner for a great length of time in countries where it is the practice to store it up for times of scarcity, it is not by any means so safe or so convenient a mode" as that which has been described above.

But Mr. Donaldson says, that, in whatever me-

thod grain is secured, it is necessary that care should be taken, that such as is soft and damp, or has been badly harvested, be not laid up with that which is dry and in a perfectly sound state; as from the quantity of moisture that is contained, and the state of germination that takes place in consequence of it, a musty bad smell is apt to be imparted to the whole, and the sample be wholly, or in a great measure, spoiled.

Some farmers have discarded the practice of exposing grain to the free action of the atmospheric air, from the circumstance of the ova or eggs of insects being liable in that way to be deposited among the corn; but it appears more probable, when the economy of such insects is fully considered, that their ova were either deposited originally among the grain in such situations, or brought in with different parcels of corn from other places. For this reason it is obvious, that great caution should be used in furnishing fresh parcels of grain for being laid up, and the use of the screen be constantly employed, before it is attempted to be so deposited.

It has, however, been well observed, that where grain is to be preserved for a great length of time, though it may, without doubt, be kept with safety by proper care and attention in granaries or corn-chambers, it is probably a much better, as well as more certain and economical practice, to suffer it to remain unthreshed from the ear, in the stacks, especially when built on proper staddles.

It is obvious, that where it is necessary to preserve corn for any length of time after it is threshed out, proper granaries should be provided; in which the size should be proportioned to the extent of the farm, being always fully sufficient to contain one half of the corn that is produced when it is threshed out. And in the provision of which the proprietors should probably, in most cases, except where very long leases exist, be at the whole of the expense of having them built.

But in those cases where the corn is ground, and afterwards preserved in the state of meal, it is the best method to pack it as closely as possible, by treading it into perfectly dry small close rooms, or chests; as when laid up in proper condition in this way, it will keep perfectly safe for a very great length of time.

It may, however, be remarked, that notwithstanding the practice of preserving grain in stacks or granaries, from the convenience and advantages of it, may in some cases be beneficial to both the farmer and the public, and of course in some degree necessary, it is clear, from the result of different experiments, "that the storing of corn in either way should be carried to as little extent as possible, as there is found to be a constant decrease in its weight, from the period at which it has been harvested or laid up; but that at first this loss is considerably greater than when the corn has been kept for some time." It has been thus stated by Mr. Holt, in the second volume of Dr. Hunter's Georgical Essays.

WHEAT.

	lb.	oz.	drs.
On being rubbed out in the hot sun, and weighed the 31st of August, 1789, soon after being cut, afforded -	0	2	11
On being weighed again on the 18th of October - - -	0	2	7
Loss of weight per bushel of 70*lbs.* nearly - - -	6	8	3

Or almost one-tenth of the whole in forty days.

Of this wheat thirty-two grains weighed one pennyweight.

The writer, however, remarks, that this is the greatest possible loss that the grain can sustain, as, though it was in a full state of maturity or ripeness, it had neither had the benefit of being dried by exposure to the sun after being cut, nor undergone the process of fermentation after it was put together.

WHEAT.

	lb.	oz.	drs.
Another quantity weighed on 22d of October, produced - -	0	6	3
Weighed again twenty-four days afterwards, afforded - -	0	6	0
Loss in that time per bushel, at the rate of - - - -	2	1	15
A further quantity weighed on the 8th of January 1790, produced -	0	2	2
Loss per bushel, on being weighed again 32 days afterwards, at the rate of	2	0	15

BARLEY.

	lb.	oz.	drs.
On being weighed on the 2d of September, under similar circumstances, produced - - -	0	2	2
On being again weighed October the 18th, afforded - -	0	1	12
Loss of weight per bushel of 60*lbs.* -	8	4	22

Or about one-seventh of the whole in forty-seven days.

Twenty-four grains of this barley, weighed one pennyweight two grains.

These facts and statements render it perfectly evident, that the more expeditious the farmer is in bringing his grain to the market, the greater the advantage he must derive from it, especially where other circumstances of a private or local nature do not operate against it. But independent of the loss that has been shown to take place from the gradual diminution in the weight of the corn, others must, in many cases, occur from the depredations of different kinds of vermin, and the effects of damps, mustiness, &c.

The preservation of grain from the depredations of insects, and other vermin of the same kind, may be best effected by timely and frequent screening and ventilation; as little or no inconvenience will follow corn or malt lodged dry, but what evidently results from a neglect of these precautions. For, whether the obvious damage arise from the weevil, the moth, or the beetle, that damage has ceased at the time the vermin make their appearance under either of these species, they being, when in this last state of existence, only propagators of their respective kinds of vermiculi; which, while they continued in that form, did the mischief.

In this last or insect state they eat little, their principal business being to deposit their ova (eggs), which unerring instinct prompts them to do where large collections of grain furnish food for their successors while in a vermicular state. It is therefore the farmer's business to prevent future generations of these ravagers, by destroying the eggs previous to their hatching; and this is best accomplished by frequent screening, and exposure to draughts of wind or fresh air. By frequently stirring the grain, the cohesion of their ova is broken, and the nidus of those minute worms is destroyed, which on hatching collect together, and spin or weave numerous nests of a cobweb-like substance for their security. To these nests they attach, by an infinity of small threads, many grains of corn together, first for their protection, and then for their food. When their habitations are broken, and separated by the screen, they fall through its small interstices, and may be easily removed from the granary with the dust. Those that escape an early screening will be destroyed by subsequent ones, while the grain is but little injured; and the corn will acquire thereby a superior purity. But by inattention to this, and sometimes by receiving grain already infected into the granary, these vermin, particularly the weevils, will in a short time spread themselves in that state every where upon its surface, and darken even the walls by their number. Upon such circumstances a hen or hens, with new hatched-chickens, if turned on the heap, will traverse, without feeding (or very sparingly so) on the corn, wherever they spread; and are seemingly insatiable in the pursuit of these insects. When the numbers are reduced within their reach, a hen will fly up against the walls, and brush them down with her wings, while her chickens seize them with the greatest avidity. This being repeated as often as they want food, the whole species will in a day or two be destroyed. Of the phalæna (moth), and the small beetle, they seem equally voracious; on which account they may be deemed the most useful instruments in nature for eradicating these noxious and destructive vermin. See *Harvesting*, *Reaping*, and *Stacking of Grain*.

Grain, the common name of a weight used for various purposes. It was originally the weight of a grain of wheat, or a wheat-corn, picked from the middle of the ear. See *Weights and Measures*.

GRAINS, the remains of different substances of the corn kind, after the brewing of beer or distilling of spirits from them. They are very useful in feeding different kinds of store animals, such as hogs, fowls, ducks, geese, &c. and also for the feeding of cattle; but in this last view, pollard, or some other dry substance, is necessary to be blended with them; they are particularly useful for milch-cows. As these substances can only be made use of to advantage while they are fresh, it is necessary, especially in the summer season, to employ means to prevent them from taking on the acetous fermentation: this is probably best effected by pressing them down tight into tubs or vats fixed deep in the ground. See *Cattle* and *Stall-Feeding*.

GRANARY, a building contrived for laying up and storing corn, in order to preserve it for a length of time. They have near Grand Cairo magazines or granaries, defended with good walls, in which vast quantities of grain are annually preserved; and many parts of Africa abound with granaries of this kind. They are frequently deep pits made in the solid rock; the descent into them being just large enough for a man to go down; but they grow larger as soon as the person is in, and are usually square, from thirty to forty feet in diameter. In these the great men of the country preserve their corn; they first cover over the floor with straw, then they lay on the corn, still, as the heap rises, placing a thin bed of straw between the corn and the sides, as they did at the bottom. In this manner they proceed till the whole cavity is filled: when this is done, they cover the mouth of the entrance with a sort of hurdle of green boughs of trees, interwoven one with another. This they cover with about two feet thickness of sand, and over this raise a ridge of earth, well beaten together, in order to throw off the rain both ways, that none may settle on the place and soak into the magazine. The corn thus stored up keeps three, four, or more years, very good; and, not unfrequently, the proprietor being taken off by the severity of the eastern governments, under which they live, the magazine is forgotten, and some accident discovering it many years afterwards, the corn is almost always found perfectly good in it. All the care they take, in regard to the grain, is to expose it two or three days to the sun's heat, to dry it thoroughly, before they carry it into the magazine.

In the duchy of Lithuania, and in the Ukraine, the people also preserve their corn in the same manner in wells or pits made in dry places: but in these countries great care is to be taken in the opening these store-rooms; for, if people descend into them before they have had sufficient communication with the fresh air, they are often killed by the damps: this, however, is easily guarded against. By these and numerous other instances of the practice of other countries, it appears evident, that subterranean granaries may occasionally be highly useful for the purpose of preserving grain.

The common granaries may also, with proper care, be rendered greatly more useful than they are at present. The grand caution necessary to this purpose is, to guard against the too great humidity, which is often the case in places where there is a great number of doors and windows. A too free access of the external air is also to be carefully guarded against; as this has not only a tendency to produce the above effect, but is liable to bring in with it the ova or eggs of a number of different insects, which prey upon and destroy the corn. A third caution is, when the corn is the produce of the country where it is preserved, not to fill the place with the crop of one place only, but to mix the harvests of two as different provinces as may be, the one dry and the other moist, or otherwise differing as much as may be; thus the contrary qualities of the one may prevent the destruction of the other. These are the principal rules to prevent the corrupting of corn: but when the mischief is once begun, it will be very difficult to stop it; all the care that can be employed should of course be taken in regard to these.

The chief points to be attended to in the erecting of granaries, are to make them sufficiently strong, and to give them such a situation as may expose them to the most drying winds. But in constructing a granary merely for the accommodation of a farm, it is unnecessary. Mr. Beatson observes, in the second volume of Communications to the Board of Agriculture, to attend to all those circumstances, respecting strength, situation, &c. which ought to be observed in building an extensive granary, where large quantities of grain are sometimes deposited. A farmer seldom wishes to have a great deal of his threshed corn on his hands at once; nevertheless, there ought on every farm, as has been seen, to be a place of security, capable of containing, at least, one-third or one-half the grain produced annually on the farm. Where the practice of housing corn is followed, there is little or no room, he remarks, within the barn for a granary; but where this is not the practice, particularly where there is a threshing-mill, the granary may easily be made over the barn; which, with proper tackle for hoisting the sacks from below, is, he thinks, the most convenient and least expensive place a farmer can have it in.

The ordering of the corn in many parts, after being separated from the chaff, dust, and other impurities, and well screened, is thus: after bringing it into the granaries, it is spread about half a foot thick, and turned from time to time about twice in a week; once a week they also repeat the screening. This sort of management is continued two months, and after that it is laid a foot thick for two months more, and during this time turned once a week, or twice, if the season be damp, and now and then again screened over. After about five or six months, it is raised to five or six feet thickness in the heaps, and then turned once or twice in a month, and screened now and then. When it has lain two years, or more, it is only turned once in two months, and screened once a quarter; but how long soever it is kept, the oftener the turning and screening is repeated, the better the grain will be found to keep. It is proper to leave an area of a yard wide on every side the heap of corn, and other empty spaces, into which it may be turned and tossed as often as there may be occasion. In Kent they make two square holes at each end of the floor, and one round one in the middle, by means of which they throw the corn out of the upper into the lower rooms, and so up again, to turn and air it the better. Their screens are made with two partitions, to separate the dust from the corn, which falls into a bag; and when sufficiently full, this being removed, the pure and good corn remains behind.

By these means, corn has been kept in granaries thirty years; and it is asserted, that the longer it is kept, the more flour it yields in proportion to the corn, and the purer and whiter the bread is, the superfluous humidity only having been evaporated in the keeping. At Zurich, in Swisserland, it is said that corn has been kept eighty years or longer, by the same methods.

The public granaries at Dantzick are seven, eight, or nine stories high, having a funnel in the midst of every floor, to let down the corn from one to another. They are built so securely, that, though every way surrounded with water, the corn contracts no damp, and the vessels have the convenience of coming up to the walls for their lading. The Russians preserve their corn in subterranean granaries, of the figure of a sugar-loaf, wide below, and narrow at top: the sides are well plastered, and the top covered with stones. They are very careful to have the corn well dried before it is laid into these store-houses, and often dry it by means of ovens, their summer dry weather being too short to effect it sufficiently.

Various contrivances have been proposed by M. Du Hamel and Dr. Hales, for ventilating or blowing fresh air through corn laid up in granaries or ships, in order to preserve it sweet and dry, and to prevent its being devoured by weevils or other insects. This may be done by nailing wooden bars or laths on the floor of the granary about an inch distant from each other, when they are covered with hair cloth only; or at the distance of two or three inches, when coarse wire-work, or basket-work of osier, is laid under the hair-cloth, or when an iron plate full of holes is laid upon them. These laths may be laid across other laths, nailed at the distance of fifteen inches, and two or more deep, that there may be a free passage for the air under them. The under laths must come about six inches short of the wall of the granary at one end of them; on which end a board is to be set edgeways, and sloping against the wall: by this disposition a large air-pipe is formed, which, having an open communication with all the interstices between and under the bars, will admit the passage of air below forcibly through a hole at the extremity of it, into all the corn of the granary, that will consequently carry off the moist exhalations of the corn. The ventilators for supplying fresh air may be fixed against the wall, on the

inside or outside of the granary, or under the floor, or in the ceiling; but wherever they are fixed, the handle of the lever that works them must be out of the granary, otherwise the person who works them would be in danger of suffocation, when the corn is fumed with burning brimstone, as is sometimes done for destroying weevils. Small moveable ventilators will answer the purpose for ventilating corn in large bins or in small granaries, and may be easily moved from one bin to another. If the granary or corn-ship be very long, the air-pipe may pass lengthwise along the middle of it, and convey air, on both sides, under the corn. In large granaries, large double ventilators, laid on each other, may be fixed at the middle and near the top of the granary, that they may be worked by a wind-mill fixed on the roof of the building, or by a water-mill. The air is to be conveyed from the ventilators through a large trunk or trunks, reaching down through the several floors to the bottom of the granary, with branching trunks on each floor, by means of which the air may be made to pass into a large trunk along the adjoining cross walls: from these trunks several lesser trunks, about four inches wide, are to branch off, at the distance of three or four feet from each other, which are to reach through the whole length of the granary, and their farther ends are to be closed: seams of $\frac{1}{16}$ or $\frac{1}{12}$ of an inch are however to be left open at the four joinings of the boards, where they are nailed together, that the air may pass through them into the corn. In some of these lesser trunks there may be sliding shutters in order to stop the passage of the air through those trunks which are not covered with corn; or to ventilate one part of the granary more briskly than others, as there may be occasion. There must also be wooden shutters, hung on hinges at their upper part, so as to shut close of themselves; these must be fixed to the openings in the walls of the granary on their outside: by these means they will readily open to give a free passage for the ventilating air, which ascends through the corn, to pass off, but will instantly shut when the ventilation ceases, and thereby prevent any dampness of the external air from entering: to prevent this more fully, the ventilation should be made only in the middle of dry days, unless the corn, when first put in, is cold and damp.

In lesser granaries, where the ventilators must be worked by hand, if these granaries stand on staddles, so as to have their lowest floor at some distance from the ground, the ventilators may be fixed under the lowest floor, between the staddles, so as to be worked by men standing on the ground, without or within the granary. A very commodious and cheap ventilator may be had for small granaries, by making the door of the granary serve the purpose, which may be easily done by making a circular screen, of the size of a quarter of a circle, behind it; but in order to this, the door must open, not inwards, but outwards of the granary, so that, as it falls back, it must be worked to and fro in the screen; which must be exactly adapted to it in all parts of the circular side of the screen, as well as at the top and bottom. But there must be a stop at about eight or ten inches distance from the wall, to prevent the door's falling back farther, that there may be room for a valve in the screen to supply it with air: which air will be driven in by the door, through a hole made in the wall near the floor, into the main air-trunk, in which there must be another valve over the hole in the wall, to prevent the return of the air.

But with the view of facilitating the labour of frequently stirring and ventilating the grain, and of lessening the expense of such buildings, a member of the Society for the Encouragement of Arts, Manufactures, and Commerce, in a letter to Dr. Templeman, recommends a new-invented granary, of which the following description is given.—It consists, he says, of seven stories of floors, and may be built of any dimensions, provided proper proportions are adhered to. The form of it is square, suppose fourteen feet square within the rooms or cells. The distance from the floor of one cell to the floor of that above is five feet; and the whole building should stand on strong posts, more or less in number, according to its dimensions, at the distance of six feet from the ground. The small stairs, or rather ladder, to go to the several cells, must be fixed to the outside of the building sideways, with a leading rail or rope to prevent falling. The whole granary to be built of what is generally called brick noggin; that is, it is first framed in strong timber work, and the interstices filled up with brick. The floors, beams, and joists, are to be made strong, to bear the weight of the corn; and the inside of the cells well lined with dry oak board, close jointed, and the outside weather-boarded, the boards being strongly nailed to the timber work of the frame, and afterwards payed over with pitch. The floors of the cells are to be so contrived as to shelve towards the middle, in which part is to be an aperture six inches square, to be opened or closed by means of a sliding shutter, which must have a long handle reaching, in a groove, without the granary. On three sides of the rooms there should be windows strongly latticed, covered with wire, to keep out large insects and birds, and with strong shutters, to defend the corn from the weather. On the fourth side is a door to each room to open from without. The windows are to be small, and as close as possible to the ceiling. Over the upper room or cell is a loft, on the outside of the door of which is fixed a crane, to be worked within by a winch and fliers. The use of the windows in the sides of the room is to give the corn all the benefit it can receive from the wind and fresh air. The door, when the cell is empty, admits the workman to sweep, dust, and clean it. The method of managing corn in this sort of granary is as follows: when the wheat is properly cleaned, it is hoisted in sacks to the loft above, and emptied through a hole for that purpose in the floor. The apertures in the floors of the cells being all open (except the two undermost, which are closed by the sliding shutters), the grain falls through till it reaches the undermost cell but one: when this is filled to the height of about two feet, which may be seen through the windows, the aperture in the floor of the next

cell above is shut by its slider. This being filled in the same manner, the next above it is also shut; and so on till the whole are filled, if required, except the undermost, which is left empty. In this condition the corn is left for a week, or more, if it was got in very dry. When it is to be stirred, the floor of the undermost cell is swept very clean, the door is again shut, and the slider in the floor above drawn back, which allows the corn to fall through into that cell. When the cell above is empty, the slider is again shut, the floor swept very clean, and the slider in the next floor over that is opened. In this manner they are all managed, till at last the uppermost cell remains empty; and the windows having all been open while the corn was falling from one cell to another, render great benefit thereto by admitting a current of air to pass through. In about a week more the next stirring is given, which is performed in this manner: Under the aperture in the floor of the lower cell, a proper screen is fixed; at the end of this screen is a conductor or spout, to which a sack is hung, its bottom resting on a miller's hand-barrow; the slider is then drawn, and the corn let fall on the screen, from which it runs into the sack: when the sack is full, the slider is for a moment shut, till another sack or another barrow is put under the conductor; the workman then wheels the first sack to the outside of the granary, and fastening the crane rope to it, it is drawn up by another workman in the loft. The same method is pursued till the lower cell is emptied. If it is necessary to screen all the corn at this time, a small screen is fixed under the aperture of the next cell to be emptied, so contrived as to have a box at the back of it for receiving all the dust, seeds of weeds, &c. that pass between the wires; and this screen is successively fixed under every aperture as the cells are successively emptied. After the first month the corn need be stirred in this manner only once a fortnight, and after the first six months only once a month, unless the weather should prove in autumn very hot and damp. The advantages of this granary, as described by the inventor, are, that it is built at a small expense; that it contains a great deal of grain in a small compass; and that the grain is easily shifted and ventilated, without the tedious mode of turning it with shovels.

But the plan of a granary, taken from one built on his own estate by a very respectable and intelligent gentleman in Cheshire, who has found it to answer extremely well, is, Mr. Beatson, in the work mentioned above, conceives, perhaps preferable to the above, not only from its cheapness, but from its simplicity, and the easy mode by which the whole body of grain is stirred, and the air conveyed and circulated through every part of it, whatever thickness or depth it is laid, and one floor only is necessary, however high the building may be. It is represented at *pl.* XLVI. in which *fig.* 1. is the front elevation; *a* door into the lower part; *b* door into the loft, to ascend to which a ladder is necessary; *c* a crane for hoisting sacks from below; *ddd*, &c. air-holes. *Fig.* 2. a section or view of the inside; *aaaaa* are wooden spouts, which reach from the air-holes on one side of the granary to those one the opposite side. These spouts are made of inch-deal, about six inches broad, and formed with an angle similar to those spouts that are sometimes used to carry off the rain-water that drops from the easings of houses. They are laid across the granary, with the angle uppermost, as shown in *fig.* 3; *bbb*, &c. are the ends of similar spouts, which cross the other ones, and reach also betwixt the air-holes on the other two sides of the granary, as shown in *fig.* 4; *ccc*, &c. are half spouts, extending in the same manner to air-holes on each side. The air-holes must have a declivity outwards, to prevent rain or snow beating in; and should likewise be secured with wire-cloth, to keep out insects or other vermin; *dd* is the floor of the granary, which is three yards square, and divided each way into three hoppers, *eee*, of one square yard each, making in all nine hoppers, as shown by *fig.* 5; *f* is a large hopper which encompasses all the rest, and has a slider at *g*, for opening occasionally when any grain is to be taken out. There is also another smaller hopper *i* suspended to this by four iron hasps *kk*, &c. which may be easily unfastened, if required, from the square deal-box *oo*, fixed to the large hopper. Through the side of this box, the handle *h* of the slider must extend. This hopper is chiefly used for the convenience of taking out a small quantity, but it is removed when a large quantity is to be taken out of the granary; *m* is a small loft, where the sacks of grain are hoisted up and emptied over the sides or rails *nn*, from which it falls down, passes through the hopper *ee* till *f* is filled (the slider *g* being closed); and as the corn is continued to be emptied from the loft, so the granary continues to fill, till up to the top, if required. The spouts being all inverted, as already mentioned, and open below, it is clear that, although the granary is filled to the top, the corn will not, like a fluid, rise within the spouts, above the level of their lower edges; and thus there will be a vacuum left within every spout, through which the air will freely pass. These spouts are placed three feet distant from each other horizontally, from angle to angle, and eighteen inches vertically; that is, from those in one tier to those of the next tier which crosses it. The holes in the bottoms of the hoppers *eee*, &c. should be so proportioned that one may not give vent to the grain faster than another; for which reason the aperture of the middle one *a*, *fig.* 5, should be the smallest, because there, there is the least obstruction. The apertures *bbbb* should be somewhat larger, as the grain will meet with some little obstruction there, by the sides of the large hopper; and the apertures *cccc* should be the largest, as the obstruction in the angles will be greater than in any other part.

It is remarked, that on viewing this granary, it is evident that, if filled with corn, and the slider *g* opened, the whole mass will be moved as the corn falls out, consequently that a new surface will successively be exposed to the air that passes through the air-holes and wooden spouts; and, thus by tak-

ing out a few bushels, perhaps, at *g*, the whole grain will be stirred above, without any further trouble. The half spouts at the sides are very useful for admitting air there also, and moving the grain, which would otherwise remain always close to the wall, which must be lined with deal, or plank, closely jointed. Care must be taken, it is observed, that the lower edges of the spouts be at least an inch lower than the bottoms of the air-holes, that there may be no probability of their being interrupted.

It is suggested as an improvement, to have a ventilator on the top of this granary, to make the current of air incline upwards, as well as through the spouts.

The principle of this granary, Mr. Beatson remarks, may be applied on any scale, from the corn-chest in the stable to the most extensive granary; but that, if a corn-chest is to be made on this plan, it should be of a cubical form, and the bottom of it made like a hopper, with a slider, as represented at *g*, or *i*, *fig.* 2, the aperture being placed about eighteen inches from the floor, to give sufficient room to take out the corn. The spouts will be easily fastened from side to side, and the air-holes should be covered with wire. A bin for containing corn for stable use made in some measure on this plan, may be seen at *fig.* 6, in which *a* represents the wall of the stable; *b* the floor of the loft; *c* the bin with air-spouts; *d* a spout below the bin or chest for letting the corn down to the stable; *e* a slider of plate-iron at the bottom of the spout, to open or shut at pleasure, but which may be locked with a padlock where that is necessary; *f* another thin iron slider, so placed, that by shutting it, when the spout is filled down to *e*, there will be contained between *e* and *f* exactly a feed of corn, which is taken away by opening *e*; then *e* being again shut, and *f* opened, another feed is let down, which, on shutting *f*, is also taken away as before, being thus repeated as often as may be necessary. By this simple contrivance, much labour and expense in grain may, in many cases, be saved by the farmer.

Where a large granary on this principle is required, it may, he says, be divided into any number of divisions, similar to that already described; the cross spouts being conducted through air-holes in the partition walls, or to perpendicular square spouts in those partitions. In this manner, different sorts of grain may be kept in the same granary.

Common granaries need not, however, have all these expensive contrivances; it will be sufficient to have them built with firmness, and well secured from the entrance of vermin. In order to effect this last purpose, they should be raised by means of stone pillars, about eighteen inches or two feet, and have a frame of some durable wood, with quarterings of timber, so placed as that they may be filled up closely with brick-bats, and the inside made secure by being lined with thin boards nailed firmly to the different pieces of quartering. The floors must be made firm, close, and even: the outside may also be covered with boarding, if it be thought necessary, and the roof well tiled. There may be different floors, or stories, according to the room required. But granaries of this sort are so common, that no representations of them are requisite.

GRANGE, a house of the farm-kind, furnished with granaries, barns, stables, sheds, &c. for containing corn and animals.

GRANIFEROUS, producing or bearing grain.

Graniferous *Pods*, such pods as contain small seeds of the grain kind.

GRANIVOROUS, feeding or living on grain.

Granivorous *Animals*, such animals as feed on corn or seed.

GRASS, in *husbandry*, is a general name applied to most of the herbaceous plants used in feeding cattle.

It is well observed by Mr. Curtis, in his tract on British Grasses, that much of our meadow and pasture-land may be rendered infinitely more valuable than it is at present, by the introduction of some of the best grasses which we possess; and that this is an opinion which has long prevailed among many of the more enlightened agriculturists of the present age, some of whom have endeavoured to excite the husbandman to collect and cultivate seeds of this sort, by writings fraught with the soundest reasoning; while others have attempted to attract him by the offers of well-directed premiums; but that hitherto neither the writings of the one, however convincing, nor the premiums of the other, however alluring, have, he thinks, been productive of the desired effect.

It is also forcibly remarked by Mr. Stillingfleet, in his Miscellaneous Tracts, that it is wonderful to see how long mankind has neglected to make a proper advantage of plants of such importance, and which in almost every country are the chief food of cattle. The farmer, for want of distinguishing and selecting grasses for seed, fills his pastures either with weeds, or bad or improper grasses; when by making a right choice, after some trials, he might be sure of the best grass, and in the greatest abundance that his land admits of. At present, says he, if a farmer wants to lay down his land to grass, what does he do? He either takes his seeds indiscriminately from his own foul hay-rick, or sends to his next neighbour for a supply. By this means, besides a certain mixture of all sorts of rubbish, which must necessarily happen; if he chances to have a large proportion of good seeds, it is not unlikely but that what he intends for dry land may come from moist, where it grew naturally, and the contrary. This is such a slovenly method of proceeding, as one would think could not possibly prevail universally; yet this is the case as to all grasses, except the darnel-grass, and what is known in some few counties by the name of the Suffolk-grass (*poa annua*); and this latter instance is owing, he believes, more to the soil than any care of the husbandman. Now, continues he, would the farmer be at the pains of separating once in his life half a pint or a pint of the different kinds of grass-seeds,

and take care to sow them separately; in a very little time he would have wherewithal to stock his farm properly, according to the nature of each soil, and might at the same time spread these seeds separately over the nation by supplying the seed-shops. The number of grasses fit for the farmer is, he believes, small; perhaps half a dozen, or half a score, are all he need to cultivate; and how small the trouble would be of such a task, and how great the benefit, must be obvious to every one at first sight. Would not any one be looked on, adds he, as wild, who should sow wheat, barley, oats, rye, peas, beans, vetches, buck-wheat, turnips, and weeds of all sorts, together? Yet how is it much less absurd to do what is equivalent in relation to grasses?

And Mr. Kent, in his Useful Hints to Gentlemen of Landed Property, asserts, that meadow and pasture-land is oftener neglected than ploughed ground, notwithstanding it generally admits of a much greater proportion of improvement. The best grasses cannot, says he, be collected at too great an expense; for he has seen a small spot of land, in the middle of a large piece, which was laid down twelve or fourteen years since, by the writer just quoted, upon an estate in Herefordshire, with some choice seeds, at the same time when the remainder of the field was laid down with common seeds; and that this spot is considerably better than the rest. From these experiments, and his own observations, he is clearly of opinion, that any person who has land calculated for grass may improve it, by this method of laying it down, to a much greater degree than he can in the common way. Dr. Anderson likewise observes, in the second volume of his Essays, that although it is probable, that none of the grasses that have been hitherto cultivated by the farmer are of the most proper kind for pasturage; yet there is little reason to doubt but that many of the most valuable kinds for this purpose would admit of being cultivated with the same ease as some of those are with which we are well acquainted, if they were properly separated from others, and cultivated with equal care. But so long as we shall remain ignorant of the peculiar qualities of each kind of grass, so as not to be able to distinguish the good from the bad, it is not surprising, he thinks, that we should remain firmly persuaded that Nature alone can provide valuable pastures, and that age is so essentially necessary for bringing them to their ultimate perfection. For, if we allow our fields to remain uncultivated, without having sowed them with any kind of grass-seeds, it must ever happen, that the seeds of such grasses as are brought by the wind, or otherwise, from the neighbouring fields, will there take root, and in time establish themselves. And as it may sometimes happen, that some of the most valuable pasture-grasses may there abound; the field, in these cases, will become filled with their seeds, and in due time may afford the most valuable pasture. But if bad kinds of grasses should abound in the neighbourhood more than the good, the field will as naturally become filled with the seeds of these useless plants. And as a number of these are hardy and abiding plants, if the field is once filled with them, the pasture will be, of consequence, always of little value, if it should be allowed to remain undisturbed for any length of time. Let the reader, therefore, says he, consider how numerous the circumstances are that must accidentally concur together before it is possible to expect a very fine field of pasture-grass, if left to Nature, and then he will perceive how improbable it is that all these should concur to produce their full effect in any one field whatever. There must be no roots of bad grasses, nor seeds of robust annuals, in the soil when it is left out from tillage; and the seeds of the most valuable kinds of grasses must be in the neighbourhood in such abundance as to fill the whole field sufficiently at once. Nor is this all. For as there are, no doubt, a considerable variety of valuable kinds of grass, some of which are naturally fitted to grow to perfection on one kind of soil, or upon that soil when in certain circumstances, while others would thrive best upon another soil, or upon that soil only in certain peculiar circumstances; it must so happen, that these very plants which are best adapted to the soil in the state it may be in at the time, should be found in abundance in the neighbourhood of the field. Neither must there be found near that, any sort of robust quick-growing plant, the seeds of which, by being blown upon that field, might suddenly rush up and suffocate in their infancy these tender and valuable plants. Nor must there be found any bad kinds of grass, that, by being established along with the good in any proportion, might tend to diminish the value of the pasture.

Now, says he, let any one reflect on the infinite diversity these few particulars may admit of, and think how utterly impossible it is that all the favourable circumstances, without any of those that are unfavourable, should concur in any one case, and he will acknowledge, that those who found their hope of obtaining the most valuable pastures only upon the fortuitous concurrence of all these circumstances, or who imagine that every pasture which is old must, on that account, of necessity be good, act in direct contradiction to the plainest dictates of reason and common-sense. For, although it should be allowed that the grasses hitherto cultivated are not of the most proper sort for forming good pastures, and that therefore, on some occasions, much better natural pastures may be met with than could be formed by means of any of these; yet it by no means follows from thence, that if the farmer were perfectly acquainted with the value and distinguishing qualities of each kind of natural grass, and knew the soil and culture that best agreed with it, the most proper manner of rearing it, and every other particular relating to the economy thereof, he might not perhaps have it in his power to form artificial pastures as much excelling the natural as these last at present usually exceeded the former. For were he possessed of the knowledge above supposed, he could at once fill the soil with the seeds of those valuable grasses which he knew were best adapted to it, and thus effectually exclude the admission of

every useless plant, or pernicious kind of grass, that might be brought from the neighbouring fields by the wind, or other accidental causes.

Let us, therefore, continues he, instead of contenting ourselves on all occasions with such pastures or grass-lands as Nature may afford, rather study to improve those that are indifferent, by endeavouring to obtain a knowledge of such plants as might afford the most valuable pasture, and cultivating these with assiduity and care. The inattention of the improving farmers in Great Britain to this subject has, he thinks, been truly amazing. But it is hoped the attempts that have been made by some late writers may have the effect of turning their attention to a subject of such great importance; with regard to which, they will then doubtless make many valuable improvements. It is, however, to be feared, that till some attempt shall be made to ascertain the particular qualities and peculiarities of the different kinds of grasses, the public will be often imposed upon by specious accounts of new grasses, which may be really possessed of few valuable qualities, and may very much tend to discourage the inquirer.

It is therefore, he says, necessary, to strenuously endeavour to discover what are the particular purposes for which any one plant could be deemed valuable, and in what respects it might be looked upon as of no value at all: For, as there is no plant that can be alike useful on all occasions, if we lose sight of this most necessary distinction, it may often happen, that we may attempt to rear a particular plant for purposes which it was never fitted to answer; and our want of success in these trials may make it be entirely rejected, even in cases for which it was extremely proper.

Ray-grass, says Mr. Curtis, continues to be the only grass whose seeds can be purchased for the purpose of laying down meadow and pasture-land; and how inadequate that grass is for such a purpose is, he conceives, known to every intelligent farmer. Why indeed the *lolium perenne* (ray or rye-grass) should originally have been made use of in preference to all the other grasses, cannot, perhaps, be satisfactorily accounted for: most probably it owes its introduction to accident, or to its being a common grass whose seeds were easily collected, rather than to its being preferred from any investigation of its merits compared with the others. However this may be, there appears to be no reason for excluding the others; for it would, he remarks, appear exceedingly improbable, that of upwards of a hundred grasses, taking the word grass in its strict sense, that are growing wild in this country, the Author of Nature should have created one only as suitable to be cultivated for pasturage or fodder. Since this period, however, most of the natural grasses have been cultivated for the purpose of affording seed, which may be procured genuine from many seedsmen in London.

Taking it for granted then, says the above writer, that there are other grasses superior in many respects to the ray-grass, this question naturally arises— How comes it that they have not found their way into general use? To this it may, he says, be answered, Improvements in any science, but more especially in agriculture, are slow in their advances; and perhaps no class of men adheres more pertinaciously to old prejudices than that of farmers.

The difficulty of distinguishing the grasses from each other has, too, no doubt, proved one grand obstacle: many of these plants are so much alike, that the most discerning botanist is often at a loss to know some of them apart: if so, how easily may the husbandman be deterred from the arduous task! There is another cause also, he remarks, which may have operated against their introduction: grasses, as well as other plants, have been frequently recommended from a partial and limited observation of them, by persons who neither knew them well as botanists or agriculturists, or who have recommended them, merely to gain by the credulity of the public. But, perhaps, the chief reason has been, that persons who might be expected to make the improvements, have not had the means fairly put into their hands to make the experiment, there not having been any easy means of obtaining such sorts of grass-seeds as may be most suitable for the purpose.

Mr. Curtis further remarks, that it appears to him, that in the herbage of good meadows, or grass-lands, there should be a combination of produce, bateableness, and early growth. The first is, in most cases, the agriculturist's grand object—and no wonder, since it is the quantity chiefly which enables him to pay his rent, and support his cattle: to obtain this, the judicious husbandman spares no expense in labour or manure. But it does not follow that produce is to be attended to solely, or that, for its sake, we are to cultivate rough cock's-foot grass, meadow-sweet, and such coarse plants. Grasses which have been recommended for being remarkably grateful to cattle, as the sheep's-fescue grass, or for the sweetness of their foliage merely, if they are found to be deficient in the grand article of produce, will never answer the farmer or grazier's purpose, since to be a good meadow it must be productive. Cattle, in regard to food, doubtless have their particular likings, though we cannot properly judge of it, in which it may be necessary sometimes to indulge them: but this practice must not be carried too far; for as the farmer cannot afford to feed his ploughmen on pigs and poultry, neither can he indulge his cattle in general with the finer or more delicate hay or herbage. By the bye, says he, we do not know but that the most productive grasses may also be the most nutritious, or that cattle will not as eagerly eat the herbage or hay made of the meadow fox-tail grass, as of the fine bent *(agrostis capillaris)*, and procumbent trefoil (*trifolium procumbens*). Moreover, cattle are known frequently to thrive on food to which they are habituated by necessity, though at first they could scarcely be prevailed on to touch it. Persons, he says, in making experiments, are very apt, as has been already observed, to conclude too hastily from the appearance

which a plant assumes on its being first planted or sown: the most insignificant vegetable will often make a great show, when its fibres have fresh earth to shoot into; but the trial comes when the object of our experiment has been in a meadow or pasture several years, when its fibres from long growth are matted together, and it meets with powerful neighbours to dispute every inch of ground with it: if it then continues to be productive, it must, he thinks, have merit. We see that lucern, when left to itself, is soon overpowered; if we sow broad-leaved clover, which is most undoubtedly a perennial, the first year we shall have a great crop of clover; let this field be left to itself, and the clover, like the lucern, will yearly diminish, not because it is a biennial, as some have supposed, but because plants hardier or more congenial to the soil usurp its place: this shows, then, that at the same time that we introduce a good plant, that plant must also be a powerful one, able to keep possession, and continue to be productive.

In regard to the second quality, or that of the cattle's thriving on the food they eat; this is, undoubtedly, of great consequence, and it is to be regretted that our knowledge of the most nutrient herbage is so limited: of those plants which have been cultivated, we are able to speak with some certainty; it is well known that clover, lucern, saintfoin, tares, and several other plants, have a tendency to fatten cattle; but what grasses, or other plants, which have not been subjected to a separate cultivation, have this particular tendency, remains to be ascertained by experiment. But as leguminous plants, in general, are found to agree with cattle, we may reasonably conclude that a certain quantity of them must be proper in pastures. Certain pastures are found to be more bateable or feeding than others; but whether this arises from situation, or their particular produce, remains, also, to be discovered by further observation.

In respect to the third quality, or the early growth of plants, as the farmers and graziers unitedly complain of the want of early herbage in the spring; those plants, therefore, which are found to put forth early foilage, and to be grateful to cattle, are deserving of great attention. As far as grases are concerned, the sweet-scented vernal, the meadow foxtail, the smooth and rough-stalked meadow-grass, will, he thinks, effect all that can be expected from those of British growth: much, very much, however, will depend on seasons: if the winter be very severe, or north-easterly winds prevail in the spring, grassy herbage will be backward: to counteract the bad effects of such seasons, our pastures should be warmly situated, not drenched with moisture, sheltered by thick hedges, and divided into small enclosures: in short, a set of enclosures should be formed for this very purpose, where there is a prospect of its answering the designs of the cultivator.

And where early pasturage is the desideratum, other plants, as well as grasses, may deserve a place amongst them, as rib-wort, or rib-grass (*plantago lanceolata*), dandelion (*leontodon taraxacum*), broad-leaved clover (*trifolium pratense*), with many others of the same kind.

And as an early herbage, though it is valuable for pasturage, is no less so for hay; by the middle of May at furthest, a meadow of this sort would be fit for mowing, and the second hay-making might commence by the time that hay-making usually takes place in the country. He has sometimes thought, but perhaps the idea is too speculative, that we ought to have two sorts of meadows, one for hay, the other for pasture; that our hay-meadows should consist entirely of grasses, and chiefly for this reason, that the hay would on that account be much sooner made; an object of consequence at all times, but more so when the process commences in May. In June and July the more powerful heat of the sun is able to exsiccate the thick leaves and stalks of the more succulent plants; but, in the necessary prolongation of this business, the grasses must materially suffer. But for the purpose of pasturage, the attention of the agricultor should be chiefly directed to such sorts of grasses as have the propensity of running to leaves, in preference to such as abound more in flower-stalks.

It is, however, observed by the same writer, that if we examine our meadows, pastures, and downs, we shall find them pretty much in a state of nature, and, excepting those pastures which of later years have been sown with ray-grass and clover, full of an indiscriminate mixture of plants, some of which afford good, others bad food, some good crops, others scarcely any crops at all: but that he may not be thought to speak at random on this subject, he will state a few facts to corroborate what he has asserted. His worthy and much-esteemed friend, Thomas White, Esq. with a view to ascertain the produce of several downs and commons fed on by sheep, procured, he says, from each of those under-mentioned in Hampshire and Sussex, a turf, which, though not more than six inches in diameter, and chosen indiscriminately, produced, on being planted in his garden, as follows:

Turf from Selborn-Common.—Plantago lanceolata, agrostis capillaris, avena flavescens, dactylis glomerata, festuca duriuscula, poa annua, cynosurus cristatus, trifolium repens, crepis tectorum, achillea millefolium, galium verum, hypochæris radicata, hieracium pilosella, thymus serpyllum.

Turf from Oakhanger.—Trifolium repens, holcus lanatus, poa annua, agrostis capillaris, agrostis palustris.

Turf from Deortun.—Ranunculus repens, lolium perenne, holcus lanatus, prunella vulgaris, festuca duriuscula, agrostis palustris, trifolium repens, crepis tectorum, achillea millefolium.

Turf from Glynd-hill—Medicago lupulina, achillea millefolium, poa pratensis.

Turf from the same.—Avena flavescens, festuca duriuscula, festuca ovina, hieracium pilosella, agrostis capillaris, trifolium repens, thymus serpyllum.

Turf from Short-Heath.—Festuca bromoides, aira præcox, juncus campestris, poa annua, agrostis capillaris.

Turf from Mount Cabron.—Rumex acetosa, daucus carota, medicago lupulina, poterium sanguisorba, festuca duriuscula, avena flavescens.

Turf from Ringmer-Down.—Linum catcharticum, scabiosa columbaria, ornithopus perpusillus, avena flavescens, festuca duriuscula, trifolium repens, hypochæris radicata, crepis tectorum, lotus corniculatis, juncus campestris, hieracium pilosella, festuca ovina, thymus serpyllum, poa pratensis.

He thinks that it is, perhaps, no small recommendation to the poa trivialis, that it is a principal grass in that uncommonly productive meadow near Salisbury, mentioned by Stillingfleet, and more particularly described in the first volume of the Memoirs of the Bath Agricultural Society.

It is added, that the account given of the extraordinary fertility of this meadow excited his curiosity, and induced him to request a gentleman residing near the spot to favour him with six small turfs, cut up in different parts of the said meadow, and which being planted in his garden, Lambeth-Marsh, produced as follows:

Turf 1.—Poa trivialis, ranunculus acris, triticum repens, agrostis palustris.

Turf 2.—Poa trivialis, alopecurus pratensis, triticum repens.

Turf 3.—Poa trivialis, agrostis palustris.

Turf 4.—Poa trivialis, triticum repens, peucedanum silaus.

Turf 5.—Poa trivialis, alopecurus pratensis, agrostis palustris, avena elatior, triticum repens.

This experiment proves, he observes, in a great degree at least, what he long before suspected, that the extraordinary fertility of this meadow arose not from any new grass peculiar to it, but from several unusual circumstances concurring and favouring in an uncommon degree the growth of certain well-known grasses, especially the poa trivialis and agrostis palustris.

In the forming and improving of grass-lands, therefore, the most certain plan will be to cultivate the seeds of such grasses as may be most adapted to them, and afterwards sow them at proper seasons upon the lands, when they have been put into a suitable condition.

The directions that Mr. Curtis gives are, that if a piece of ground can be had that is neither very moist nor very dry, it will answer for all the seeds; they may then be sown on one spot: but if such a piece cannot be obtained, they must be sown on separate spots, according to their respective qualities, no matter whether in a garden, a nursery, or a field, provided it be well secured and clean. Dig up the ground, level, and rake it; then sow each kind of seeds thinly in a separate row, each row nine or twelve inches apart, and cover them over lightly with the earth; the latter end of August or beginning of September will be the most proper time for this business. If the weather be not uncommonly dry, the seeds will quickly vegetate; and the only attention they will require will be to be carefully weeded: in about a fortnight from their coming up, such of the plants as grow thickly together may be thinned, and those which are taken up transplanted, so as to make more rows of the same grass. If the winter should be very severe, though natives, as seedlings they may receive injury; therefore it will not be amiss to protect them with mats, fern, or by some other contrivance. Advantage should also be taken of the first dry weather in the spring, to roll or tread them down, in order to fasten their roots in the earth, which the frost generally loosens; care must still be taken to keep them perfectly clear from weeds. As the spring advances, many of them will throw up their flowering stems, and some of them will continue to do so all the summer. As the seed in each spike or pannicle ripens, it must be very carefully gathered, and sown in the autumn, at which time the roots of the original plants, which will now bear separating, should be divided and transplanted, so as to form more rows: the roots of the smooth-stalked meadow-grass in particular, creeping like couch-grass, may readily be increased in this way; and thus, by degrees, a large plantation of these grasses may be formed, and much seed collected for the use of the agricultor.

But a more ready way, according to the editor of the New Farmer's Calendar, is, for the farmer to notice that species of grass most affected by his soil, and carefully to gather the seed from a piece of old meadow, purposely left three or four weeks longer than common, or at least long enough to become sufficiently ripe. He should not scruple the trouble of selecting the heads as they lie in the swath; but they who desire not to be so particular, will thresh out the seed together, either in the field or before it shall have heated in the mow.

Good seeds of different sorts of grasses may now also be procured from different seedsmen in London, and other places; but the collection sold under the title of hay-seeds should never be trusted to.

The late Mr. Curtis, from the numerous applications that were made to him by gentlemen for grass-seeds, was induced to select such as appeared to him the most useful, and thereby rendered the public an essential service. He wished at least to put it in their power to decide on a matter which had been long agitated, and from which he was far from being the only one that entertains the most sanguine hopes of its proving a great national advantage. The grasses he has recommended will, he is confident, do all that our natural grasses can do: they are six of those which constitute the bulk of our best pastures most of them are early, all of them are productive, and they are adapted to such soils and situations as are proper for meadows and pastures. But, says he, let no one expect them to perform wonders; for after all they are but grasses, and as such are liable to produce great or small crops, according to particular seasons, or to the fertility or barrenness of the soil on which they are sown.

In this list he comprehends the *anthoxanthum odoratum*, or sweet-scented vernal-grass; the *alopecurus pratensis*, or meadow fox-tail grass; the *poa pratensis*, or smooth-stalked meadow grass; the *poa trivialis*, or rough-stalked meadow grass; the *festuca*

pratensis, or meadow-fescue grass; and the *cynosurus cristatus*, or crested dog's-tail grass; representations of each of which may be seen at *figs.* 1, 2, 3, 4, 5, 6, in *pl.* XLVII. and more full accounts of them found by referring to their different botanical titles.

It is added, that of the above grasses, the meadow fox-tail and rough-stalked meadow grass are fittest for moist land; the meadow-fescue, or sweet-scented vernal, are the most proper for land either moist or moderately dry; and the smooth-stalked meadow-grass and crested dog's-tail are those that are best suited for dry pastures.

He thinks, however, that in the more southern parts of the kingdom we may in vain expect to clothe dry soils with the constant verdure of grasses; they will not stand the drought of hot parching summers: in such seasons, it is only plants which send down roots to a great depth that can be expected to look green or be productive, as the lotus corniculatus, medicago falcata, &c.

In respect to the order of flowering in the above grasses, it is as follows: 1. Sweet-scented vernal. 2. Meadow fox-tail. 3. Smooth-stalked meadow. 4. Rough-stalked meadow. 5. Meadow-fescue. 6. Crested dog's-tail.

He says, that he might easily add many more grasses to this list, and those too which perhaps might be highly deserving of it; but he has his doubts, whether by recommending more he might not increase the difficulty of introducing grass-seeds without any adequate advantage.

And besides most of the above, Mr. Sole, an intelligent botanist, in the ninth volume of the Memoirs of the Bath Society, has given representations of the *festuca ovina*, or sheep's-fescue grass; the *festuca duriuscula*, or hard fescue grass; the *poa compressa*, or flat-meadow grass, the *poa palustris*, or marsh-meadow grass; the *phleum nodosum*, or knot-grass; and the *lolium perenne*, or rye-grass, which is an useful grass in many cases. They may be seen at *figs.* 1, 2, 3, 4, 5, 6, in *pl.* XLVIII.

Dr. Anderson, in the second volume of his Essays on Rural Affairs, besides several of these, has likewise given delineations and descriptions of many others, which, he conceives, may be beneficially employed in forming grass-lands, such as the *alopecurus bulbosus*, or bulbous fox-tail grass; the *festuca rubra*, or purple fescue-grass; the *holcus mollis*, or creeping soft grass; the *plantago angustifolia* and *tenuifolia*, or narrow-leaved and small grass-leaved plantain or rib-grass; and the *poa procumbens*, or creeping-meadow grass.

The Rev. Arthur Young, in a valuable Essay on the Conversion of Grass-Land into Tillage, inserted in the Communications to the Board of Agriculture, vol. III. part I. gives the following detail of several plants of the grass kind, with the soils they are most proper for, or on which they succeed to the greatest advantage.

Ray-grass (*lolium perenne*). This grass, which for many purposes is a very valuable one, is chiefly, he says, to be recommended for the two divisions of soil distinguished under the titles of loam, and sand. It will flourish on any land, except stiff clay, and will grow even on that; but, upon rich sands and loams, it becomes not only a good spring-grass, but, if properly managed by due mixtures, turns out well as a permanent pasture-land; always, however, most valuable by being sheep-fed, for which it is singularly adapted. Mr. Peacey's two varieties of it are said, by some persons who have tried them, to be superior to the common sort. Mr. Professor Martyn, he says, states the *cynosurus cœruleus*, *poa nemoralis*, *bromus mollis*, *alopecurus*, *anthoxanthum*, and *poa pratensis*, as all being earlier than the *lolium perenne*, or ray. See *Lolium Perenne.*

Yorkshire white (*holcus lanatus*). This, he observes, flourishes well on any moist soil, and grows very generally, except on the most dry and barren ones, where, however, it is also found. It should be sown chiefly with a view to sheep, for it is not equally good for other stock: many acres of it have been cultivated on his farm for sheep, and it has answered greatly when kept close fed. Mr. Marshall, in his Midland Counties, he remarks, mentions it as a good grass for cows and other cattle, but bad for horses. In his York Economy he, however, condemns it in toto; probably from not then having so closely remarked its qualities. See *Holcus Lanatus.*

Meadow-fescue (*festuca pratensis*) is, he says, an excellent grass for good loams and clayey soils, and he has found it abound largely on dry loams. He has laid down some parts of fields with it for comparison with other grasses on wet sandy loams on a clay marl bottom, worth 14*s.* or 15*s.* an acre; but has found it giving way in four years to the plants more indigenous to the soil. He does not think there is any better grass for either hay or pasturage, and it yields seed in great abundance. He adds, that Colonel St. Leger was, he believes, the first who entered largely into the culture of this grass; and Mr. Majendie, of Essex, revived it, and began with the *alopecurus.* See *Festuca Pratensis.*

Meadow fox-tail (*alopecurus pratensis*). He thinks that for moist loams and clays, there cannot be a better grass than this: it is very early, and it abides on his farm after nine or ten years on the soils upon which the meadow-fescue gives way to others. It has also been found, he says, by Mr. Majendie, hardier against frosts than the *poa trivialis*: the greatest objection to it is the difficulty of getting the seed in any degree of plenty; there is an insect that feeds on it, and occasions much disappointment. Mr. Professor Martyn, in his excellent Flora Rustica, speaks, he observes, highly of this grass, and says the seeds may be collected without much difficulty; but he does not there advert to the insect which is so pernicious, as noticed by Mr. Majendie, and by the ingenious Mr. Swayne, in his *Gramina Pascua.* In a field on his farm, where it is very well established, and the herbage thick, it produces very few seed-stalks. See *Alopecurus Pratensis.*

Crested dog's-tail grass (*cynosurus cristatus*). It is remarked, that to judge from the appearance of the bents of this grass in poor upland but moist pastures, a man would think it a very unpromising plant: but the rich marshes of Bridgewater and Boston, the famous pasturages of Painton in Devonshire, and those close to Mr. Buller's castle near Leskeard in Cornwall, Mr. Thorne's bullock-grounds on a limestone bottom near Tavistock, Mrs. Williams's at Little Malvern in Worcestershire (which are among the richest pastures in the kingdom), all abound, he asserts, very greatly in this grass; in some of them it is the predominant herbage. Mr. Marshall, in his York Economy, places it as the most prevailing plant in the best grass-meadows of the vale of Pickering, some of which will feed a large cow from May-day to Michaelmas. Very fortunately it abounds much with seed, so that he has had many bushels gathered in a season by poor women and children, at 1*s*. a pound, and laid down many acres with it successfully. Attention should be paid to its being ripe; for he once ordered eight bushels to be sown on eight acres, and it failed from deficiency in ripeness. See *Cynosurus Cristatus.*

Rough-stalked meadow-grass (*poa trivialis*). It is observed that Mr. Boys, of Betshanger, in Kent, has been the largest cultivator of this grass in the kingdom, and sold large quantities of the seed, but gave it up for want of a demand. It is, he asserts, an excellent grass on good, sound, and moist loams. It is accounted in Lombardy "the queen of meadow plants (*la regina dell' erbe*)," whether for dry pastures or water meadows; multiplying itself much by seed, and little by the root; so that, if attention be not paid to permit some seed to fall, its quantity will sensibly diminish. Excellent for all sorts of cattle.

This hint concerning the seed is, he thinks, worth attention in England. Major Cartwright has found the *poa pratensis* to be an excellent grass on rich loams; and both succeeded well with Sir William Clayton, of Harleyford. See *Poa Trivialis.*

Cock's-foot (*dactylis glomerata*). This grass has, he says, been largely cultivated over the farm he now manages, and to his satisfaction on wet loams on a clay marl bottom, upon which the finer grasses are apt to give way in a few years to the indigenous produce. If suffered to rise high, it is very coarse; but, fed close, is a very valuable sheep-pasture. Women and children make good earnings in gathering it at 4*s*. a bushel. He has sown two bushels an acre, and 10lbs. common red clover; and when the clover wears out, the grass fills the lands, and abides well in it. It grows well in winter. It has been found highly useful as an early sheep feed. It is seen at *fig.* 6. *pl.* XLIX.

It is stated in the Norfolk Report on Agriculture, that, "Sir Mordaunt Martin, in 1788, observing, by an experiment, that this grass grew four inches in less than three days, determined to attend more particularly to it: he remarked, that when sheep were let out of a fold, they ran over every thing, to get at a baulk that was full of it, and there ate it in preference to other grasses. In some parts of Norfolk it is called cow's-grass, from their being very fond of it. He began to cultivate it in 1794. It grows at Midsummer, in a drought, when every thing else is burnt up. He sows it with nonsuch, instead of ray-grass, and finds it much more profitable." And "Mr. Overman, also, observing the eagerness with which sheep, when let into a field at Burnham-market that had some cocksfoot grass in it, ran over ray-grass, and every thing else, to get a bite of this plant, thought it worth cultivating, and sowed about an acre, on the dry gravelly part of his farm, just above the marsh. This spot was the only one, in a large field, that did not burn in the severe drought of 1800, and convinced him of the excellence of the grass." He also showed the writer "a beautiful crop of drilled wheat, which could scarcely be estimated at less than four quarters and a half per acre, pointed out a part of the field, superior, if any thing, to the rest; and said it was an experiment on the cocksfoot grass: he had found it an excellent plant for sheep, but having examined the roots, perceived them to be so strong, that he had some suspicion they might exhaust the land, and therefore sowed this piece for a trial: the result has satisfied him that all apprehension of the kind was ill-founded, and he intends substituting it for ray-grass." The author has also "cultivated this grass on a large scale for many years, and has found it of great use. It is a most valuable plant when kept close fed." See *Dactylis Glomerata.*

Tall oat-grass (*avena elatior*). This is, he says, another coarse grass, profitable when kept close fed: the seed might be had in any quantity from France, or gathered by hand in England. In the Rev. Mr. Swayne's experiment, it yielded, he says, a greater weight than any other grass. See *Avena Elatior.*

Timothy grass (*phleum pratense*). This grass is represented by all travellers in America, he observes, as the great support of cattle, &c. wherever meadows are found; and it is asserted to have considerable merit. He has several times made the trial of keeping it close fed by sheep on a moist loam, upon a clay marl bottom. The success was very encouraging; enough, he thinks, to prove that it is an object, in this line of husbandry, which merits considerable attention; and the more, as the seeds are to be had, very clean dressed, in any quantity from America, at about a guinea a bushel; which is sufficient, with other plants, for four or five acres of land. He believes it is best adapted to clay, moist loams, and especially peat. See *Phleum Pratense.*

Yarrow (*achillæa millefolium*). This, he asserts, is one of the most common and most valuable plants that is to be met with in England. On his farm the cultivation of it has been carried on with success as a sheep-pasture for some years. It is found on moist loams almost equally with dry burning sands, gravels, and chalks. It has a singular quality of resisting drought on the most arid soils; so that, if you see at a distance a green spot on a burnt-up close-fed pasture, twenty to one but it is clothed with this plant. It is found in the richest meadows

and bullock-pastures. Five shillings per bushel are given for gathering the seed in October: it is a plant deserving great attention. Sheep are very fond of it. It is said to form a fourth part of the herbage of some of the fine meadows of Lombardy.

Burnet (*poterium sanguisorba*). It is remarked that there are large tracts of the finest parts of the South Downs upon which this plant forms half the indigenous pasturage. It abounds much also on all other chalk downs; but it will flourish on any soil, on sand, clay, peat, &c. Some writers speak of it for cows: it has been cultivated on his farm these five-and-twenty years for sheep, for which animal it is very useful. The seed is, he says, to be bought almost every where. See *Burnet*.

It is observed in the Agricultural Survey of Norfolk, that this plant was "introduced at Stoke 35 years ago, as the writer then registered, with great success; but it never made any progress, though it yielded luxuriant food for many horses in February." However, "the reputation of this plant attracted the notice of Mr. Coke, who formed an experiment at Holkham, to examine carefully its merits, and, with the spirit that characterizes his husbandry, sowed 40 acres, mixing a small quantity of white clover and rib-grass with it.—The result was as decisive as can be imagined; the field has being fully and incessantly stocked with sheep, and was constantly pared as close to the ground, as a favourite spot in a pasture is by horses." And in other respects it is also valuable, as "Mr. Bevan has found it to be the most wholesome food for sheep in a wet spring, and a certain remedy for the flux." And he "is never without 20 acres of it."

White clover (*trifolium repens*). It is asserted that this plant has hitherto been the main dependence of those who have laid down land to grass; and though, for sheep, it has not the sweetness of some other plants, or of red clover, yet upon the whole it is one of the best that can be relied on for all rich or dry loams, sands, &c. and also for rich and drained clays and peats; but on poor wet loams and clays it will not abide, but gives way to the water-grass (*agrostis stolonifera*) and noxious plants, or other indigenous grasses. There is no better test of good land, he thinks, than its running spontaneously to this plant; from the fine loams on rock, upon the Tamar, to the deep friable ones of Leicestershire, red-clover, left unploughed, gives way to a thick covering of this plant. Whatever seeds be sown, this clover should form a part of the dependence for success. Mr. Bakewell, Mr. Wright of Norfolk, and several other practical farmers, made this observation, that stock has been known to do badly, though much food on the ground; perhaps that is precisely the reason; and that this plant, like so many others, demands very close feeding to discover its merit. See *Clover*.

Trefoil (*medicago lupulina*). It is observed that, though only a biennial, it is sure to shed so much seed that it rarely wears out of land. It is a good plant, not at all nice in soil, and the seed cheap. See *Trefoil*.

Cow-grass (*trifolium medium*). An excellent plant for clays and strong loams. It is said, in the Lincoln Report, that Mr. Ancel got good crops on a rabbit sand; the hint is, he thinks, worth pursuing, but he has not seen it cultivated on such soils. It is much more abiding than common clover. The seed is always to be had: it is known also under the name of marl grass. Mr. Bakewell's method of laying down was, by common red clover and ray grass, being sure of plenty of white clover and good grasses coming: but he prepared by two crops of turnips in succession, and sowed with the barley following. On such land as his, the practice is not to be condemned, but on other soils it would fail entirely. See *Cow-Grass*.

Rib-grass (*plantago lanceolata*). It is asserted that upon rich sands and loams this plant gives a considerable herbage, and on poorer and drier soils it does well for sheep; but that it is inferior to some others. Mr. Marshall, he says, observes, that it has stood the test of years' established practice in Yorkshire, and is in good estimation; though not well affected by horses, and bad for hay, from retaining its sap. The eminent Haller informs us, that the astonishing richness of the famous dairies of the Alps, described by Scheuchzer, is attributed entirely to the plenty of this plant and the *alchemilla vulgaris*. The seed is always plentiful. See *Plantago*.

Lucern (*medicago sativa*). This is more confined than any of the other plants. A landlord should, he thinks, only stipulate for it on very rich, deep, friable, dry, sound, mellow loams, and fertile sands, worth 30*s*. an acre. Upon such lands, he cannot do better than to encourage it among the tenantry, to be sown broad-cast, 20lbs. an acre, and to remain while productive, which will be from twelve to fifteen years. On such soils it will, he says, support more cattle than any other plant. See *Lucern*.

More full accounts of these grasses will be found under the different heads which are referred to.

In respect to *hay-seeds*, it is stated that the only case in which these are admissible is, when a person has a very clean and valuable meadow or pasture which he saves with a view for seed; drawing out the bad plants whilst the crop is on the swath, and threshing the produce on a cloth, after standing till the seeds be ripe. Thus managed, excellent seed may, he asserts, be procured with ease, and be beneficially employed in the forming of grass-lands.

The arrangement of these different grasses, as they relate to, or are proper for different sorts of soil, is fully shown in speaking of the methods of bringing land into the state of grass. See *Laying Land down to Grass*.

Besides the plants that have been noticed above, it "is remarked that there are many others, some of which have been tried under his direction, which deserve much attention; but he has not named them in the above-mentioned list, because the seed cannot be procured but with difficulty: some perennial vetches, clovers, melilots, lotuses, &c. &c. And several others are highly spoken of by some writers;

yet, as his own trials have not been equally successful, he is not authorised to recommend them. He never tried the *vicia sepium* sufficiently, he says, to give an opinion of it; but, by Mr. Swayne's account, it deserves much attention."

In considering the modes of laying lands to the state of sward, lists containing the proportions or quantities of different sorts of grass-seeds suitable for different sorts of land, are offered to the attention of the reader. See *Laying Land down to Grass.*

The able writer mentioned above has remarked in a general manner, "that if the land laid to grass be intended for sheep, it is not an object of very great consequence to sow only the finer grasses; as close feeding after the first year will make any grass named in the lists fine, sweet, and productive: but this effect depends altogether on its being constantly fed close, that is, all seed-stems being prevented from rising. Every good farmer is, he says, sensible of the necessity of this with ray-grass, but most unaccountably does not extend a similar concern to other grasses. Above 200 acres under the author's management have been laid down to grass, chiefly for sheep; and he has stocked the fields so early in spring, and so thickly, as just to keep down the seed-stems: the cock's-foot, oat grass, and Yorkshire white, with this management, have proved sweet feeding grasses, not at all rejected, even in fields where the flock had a choice. Several writers seem to have been very sensible of the consequence of close feeding. Mr. Davis, in the Wiltshire Report, says, "the sweetness of the feed on the downs of Wilts depends much more on its being kept close, and eaten as fast as it shoots, than on any particular good quality of the grass itself; for there are many downs that, when close fed, appear to be a very sweet pasture; but which, if suffered to run a year or two without a full stock on them, will become so coarse, that sheep will almost as soon starve as eat the grass."

And it is remarked, he says, in the Survey of the County of Stirling in Scotland, that, "upon Benlomond, &c. the pasturing of sheep has evidently, in the course of twenty years past, improved the quality of the herbage so as to raise grass of a good species, and in very considerable abundance, where nothing formerly prevailed but bad kinds of grass, and these in no great plenty: and the practice bids fair to banish heath from all the places that are pastured by sheep."

Lisle, he says, who was the best writer on husbandry we had for many ages, also remarks, "that there are poor soils which require a much longer time to grow a second inch than the first, and that consequently on such it is much more profitable to keep sheep than cattle." The writer, on first reading this passage, made the experiment on land of 12*s.* and 15*s.* an acre, clipping the plants with scissars, and carefully measuring and weighing the produce, and comparing it with neighbouring plants left to perfect the seed-stem; the superiority was proportioned to the times of cutting. Sheep-feeding not only, he says, ameliorates, by enriching the soil and fining the herbage, but also by destroying weeds. Ragwort, with which the bullock-grounds of Limerick are over-run for want of sheep is, he observes, much effected by them: and Mr. Marshall, in his York Economy, gives, he says, an instance of a meadow, foul in the extreme with knobweed, cured by pasturing it repeatedly in the spring with sheep. But here, says he, a counter remark must be made, which is, that after a field has been pastured long with sheep, and close fed, it becomes unable to yield a growth of hay: the plants, by being constantly cropped down, acquire a dwarfish habit, however quick the growth in that early stage. There is a small field on the estate which he manages, which has been under grass time immemorial, and kept fed for the last forty years at least, except one year in which it was mown, expecting a vast crop: the season was very favourable, but he was utterly disappointed, for the produce was small. He has known the same thing happen on inclosing an old common. In Scotland a similar remark has been made by Mr. Wight. "Two inclosures of the same soil were laid down together with grass-seeds of the same kind: after two years' hay the one was surrendered to pasture; from the other a crop of hay was taken every other year. After seven years' absence the proprietor returned home, and wanting more hay, mowed both, and that which had been pastured gave the worst crop." Something like the same thing has been observed in Switzerland, as stated in the Transactions of the Berne Society.

In the forming of grass or sward, the procuring of good seed has been found, from long experience in every part of the kingdom, to be of all other works worst executed by tenants: they sow the cheapest seeds which can be procured, that is, common clover or ray, or the rubbish of their hay-lofts: the clover gives a crop the first year; but, as it wears out, all sorts of trumpery succeed, if the soil be not good enough to run spontaneously to white clover. Great care should therefore be taken by the owners of lands, which are to be brought into a state of grass, to have proper sorts of grass-seeds provided. About 25*s.* will purchase the seeds in most instances: the expense may be reckoned from 20*s.* to 30*s.* per acre; but depending on various circumstances, as the state of markets, and the price of labour. Of the seeds recommended, the following are to be bought in any quantity: cow-grass, Yorkshire white, Timothy from America, white clover, trefoil, ray, burnet, rib. And dog's-tail and cock's-foot are easily gathered by hand. Most of the grass-seeds that have been recommended as useful in forming good grass-lands may indeed, now, we believe, be had, either from Mr. Salisbury, the intelligent successor to Mr. Curtis, at the Botanic Garden, Brompton, or the seedsmen in London.

The best methods of preparing the land, sowing the seeds, and managing the new grass-lands, are shown in treating of the practice of restoring lands to grass. See *Laying Lands down to Grass.*

Grass, *Artificial*, that sort of grass that is produced by the sowing of the seeds of different kinds of luxuriant plants, such as those of *red-clover*, *white-*

clover, *saintfoin*, *lucern*, *trefoil*, *burnet*, *tares*, &c. See these different heads. Representations of them are given at *figs*. 1, 2, 3, 4, 5, &c. in *pl.* XLIX.

It has been observed by a late practical writer, that "though the chief hinge on which modern husbandry has been made to turn is that of the introduction of these sorts of grasses, it is extraordinary that they have yet, in but few districts, been made to constitute a part of the course of cropping on arable land. In all well cultivated districts, they, however, form a considerable proportion of the crops. The first of the above, he says, is a most invaluable plant, whether it be mown and used green, pastured, or made into hay. And that by its long tap-roots it resists the effect of excessive drought on the dryest soils, and increases the quantity of vegetable mould in all. It will grow on most soils, but is not equally productive; and whether it be mown and used in the green state, pastured, or made into hay, it generally produces four or five times the quantity of fodder that the same land would have done with common grasses. Further, that in good rotations, it frequently makes the second crop, in lieu of white corn mown once, and the after-grass eaten off with horses, beasts, or sheep, and the land sown with wheat. In that case, two pecks of the best ray-grass, mixed with fourteen pounds of the clover-seed, should be sown upon an acre, which not only increases the quantity, but also greatly improves the quality of the hay. If the clover is for stall-feeding, the ray-grass should be omitted. But that, in poor light soils, the better way is to take two or three crops of corn, and then to lay the land down to rest, three, four, five, or six, years. In this case, he would advise the farmer to sow the following seeds, in these proportions per acre:

Burnet	- -	4 pounds
Cow red-clover	-	4 ditto
White clover	-	8 ditto
Trefoil	- -	4 ditto
Ray-grass - -	-	2 pecks
Vernal grass	-	$\frac{1}{4}$ ditto
Sheep's-fescue grass		$\frac{1}{2}$ ditto
Crested dog's-tail grass		$\frac{1}{4}$ ditto

As he thinks that, by this management, the soil would acquire a vast increase of vegetable mould, and, by the pasture maintaining one-fourth more stock than it did before, it would be greatly charged in manure; by which means the land would be kept in perpetual good condition: And, when brought under tillage, produce one-fourth more corn than it did under other circumstances."

It is remarked, in the Norfolk Survey, that "Mr. Purdis, of Eggmore, was recommended by a friend, whose management he had seen and approved, to sow his seeds at twice: half of each sort (white and red clover, and ray) at the time of sowing barley; and the other half before the rollers in going over the young crop: and this practice he intends to pursue in future. He thinks it will give them a better chance of succeeding. He has 600 acres of seeds: he sows the great quantity of 14lb. an acre of white clover, 8lb. of red, and one bushel of ray-grass. The last he esteems much in spring; and, when an observation was made against it, said, that in April and May he had 3000 sheep that found the excellence of it." This should be attended to by the farmer.

The author of this Survey states, that "in 1784, registering the husbandry of the spirited cultivator of Holkham, it was remarked, that 'those who have been conversant in the husbandry of old improved countries, know that a common complaint is the failure of red-clover. It has been sown so repeatedly, that the land is said to be surfeited with it. In the same district it comes to nothing on the old improved lands, yet yields immense crops on any accidental spot, where never, or rarely, sown before.' The observation is, he says, so common, that no doubt can remain of the fact; however, it may be attributed to certain methods in management pursued in this county. Peas and tares had been tried as substitutes, but they are tillage crops, and what these thin soils, harassed with the plough, want, is rest. Mr. Coke, he adds, turned his views to a different and better quarter, to other artificial grasses, which would answer the same purpose as clover and ray-grass. He had recommended to him, on a former occasion, trefoil, white clover, cow-grass, rib-grass, and burnet. Mr. Coke applied them with no inconsiderable sagacity to the present purpose, and that the experiment might not be delusive, tried them spiritedly upon 30 acres in the middle of a large piece, laid with clover and ray-grass. The quantities of seed he has found will vary according to circumstances; but in general,

Of cow-grass	-	8 to 10 lb.
White clover	-	5 to 8 lb.
Rib -	-	5 to 8 lb.
Burnet -	-	5 to 12 lb.
Trefoil - -	-	5 to 8 lb.

according to the price, and also the intended duration of the lay. The success of the first trial induced him to lay down a yet larger space the second year. And the third (with the barley of the last spring), no fewer than 221 acres: this is, in truth, says the writer, doing justice to a new husbandry. Mr. Coke has found that those seeds fill the land completely with plants, which are abiding two, and even three years; and how much longer they may last, is more than he can pronounce, as their appearance is yet as good as ever. The author rode over all the pieces, and never saw a finer or more regular plant than they exhibited. And he has, on several occasions, remarked, that sheep give a preference to these grasses, whenever sown in the same field with clover and ray-grass." And it is added, that "in regard to the continuance of these trials, some of the pastures now remain, and are as fine as the soil will yield: thick, clean, and sweet."

It is here remarked by the able surveyor, in regard to land being tired of this plant, that the observation he made, "during nine years that he was in the constant habit of viewing the farm of Mr. Arbuthnot,

in Surrey, merits some attention. When he began to farm, the land was sick of clover, insomuch, that it was almost sure to fail, from having been, perhaps for a century, sown every four or five years. His friend adopted the course of—1. beans; 2. wheat; 3. clover, in which it occurred once in three years, and the farmers predicted on absolute failure: he viewed three courses, and better crops, of pure red clover, were never gained. He began with ploughing treble the depth of that to which the land had been usually stirred, and he manured very amply for every crop of beans, partly with night-soil, from London. In what degree the success arose from depth of tillage, and what degree from a variation in manuring, cannot be ascertained; but the experiment proved that these agents were equal to the cure of the malady."

And it is further noticed, that "some farmers in Norfolk, have moved out of the common sphere, and ventured to plough deeper than their predecessors; nor have they found any inconvenience in so doing. It merits consideration, whether this practice will not prove in some measure a remedy to the failure of clover. As to manuring, and especially in great variations, the means are generally limited, and a change in this respect, however desirable, is rarely in their power." But "the only effective remedy hitherto practised, is that of omitting clover altogether, for one or two rounds, which points out the great importance, he says, of introducing as many new artificial grasses as possible."

The red-cow clover is another plant of the clover kind, which is very useful as an artificial grass. According to Mr. Amos, it is perennial, and grows naturally in high chalky fields, and in gravelly fields with clay beneath. In the most improved part of the country, when the land is to rest for some years, this seed is sown along with the white clover, as it continues in the ground much longer than the meadow-trefoil, and is nearly as productive, especially on chalky and poor sorts of land.

It is further observed, that where a crop of any of those clovers is taken in lieu of a crop of corn, the grain should be sown first, but less in quantity than if no seeds were sown with it; and, after the land has been made fine by harrowing and rolling them, fourteen pounds of clover-seed, and two pecks of best ray-grass, should be sown upon an acre bush-harrowed the length way, and rolled the cross way of the ridges: afterwards the whole must be well gripped or drained. Nothing more is necessary to be done, on account of the seeds, till the next spring, when the land should be well dressed with the sward-dresser or harrows, drawn with long bushy thorns, the latter end of March, or the beginning of April; then cleaned and rolled the cross way again. In all these operations, the land should be neither too wet nor too dry, but in a due medium with respect to both these extremes, as, under other circumstances, they do not succeed so well.

It is added, that the time for cutting those two grasses is, when they are in full flower, and rather showing evidences of declining.

The white clover is, in Mr. Amos's opinion, the sweetest grass for all sorts of stock yet known, and makes the closest sward, and is very productive of foliage. Hence it is, he thinks, most peculiarly adapted to laying down land to pasture. It flourishes most upon such dry warm soils; yet it will accommodate itself to most kinds. It is seldom sown alone, unless it be to raise the seed; nor should it ever be mown for hay. In laying down rich soils, which are intended to remain in pasture for many years, this seed should predominate in the composition that is made use of.

It is, however, stated, in the Agricultural Report of Norfolk, that "Mr. Wright, of Stanhow, does not like white clover; he thinks it a bitter food, and that sheep do not eat it kindly; so that while much food seems to be on the ground, stock do badly. This is an uncommon opinion, but the author remembers Mr. Bakewell starting the same idea."

The procumbent or hop-trefoil, is another plant of this sort, which is not very productive, and thrives best upon dryish gravelly fields, and pastures which have the same nature. They are both perennial.

The saintfoin is a plant of the artificial grass kind, which produces, Mr. Amos says, the best crops upon light rich land; but it will thrive upon the thinnest limestone, gravelly, and chalky soils, with great luxuriance, even where these are so poor as to afford a very scanty crop of any of the other sorts of grasses. It thrives best when sown alone, though it is frequently sown with barley and oats, by cultivators that have not much experience of it.

It is advised, that upon whatever soil it is sown, the land should be brought into a very fine and clean tilth by culture. And, that about the latter end of March, or beginning of April, it should be ploughed, and if it is roughish, be harrowed once in a place; then upon every acre, sixteen pecks of saintfoin seed should be sown; then harrowing the land well, and sowing eight pounds of common red-clover or trefoil upon every acre afterwards, the land should be bush-harrowed and rolled. And, where weeds appear, they must be destroyed as they come up, by hand, or other means.

It is recommended, that no stock be suffered to graze upon the seeds the first year; and, if it be top-dressed with one quarter of rape or bone-dust to an acre, about old Michaelmas, the plants are greatly invigorated and benefited.

It is stated, that, upon such lands as the above, it furnishes a crop of hay in summer of greater consideration than any other of the artificial grasses. The hay is excellent for all kinds of stock, and the after-math very good for cattle in autumn, and for sheep in winter, till Candlemas. Hence, saintfoin is a most invaluable grass on limestone, gravelly, and chalky soils; but it requires three years in coming to perfection; hence the propriety of sowing common red-clover or trefoil along with it. And it should be mown before it is in full blossom, otherwise there may be loss.

The lucern is asserted, by the above writer, to be the most productive, and that which comes into use sooner than any other of the artificial grasses. Horses, beasts, sheep, and pigs, are very fond of it, when it is mown and given them green, which is the most useful application of it. It is found to thrive best on rich, dry, loamy soils, which should be made deep, fine, and clear of weeds by culture. And, he advises, that about the middle of April, ten pounds of seed should be drilled on an acre, in rows of eighteen inches asunder, and one inch deep, with a row of common red-clover between each; then bush-harrowed and rolled. Nothing more is necessary to be done till weeds appear, when it should be hand-hoed well, and the weeds in the rows pulled out by the hand. As soon as more weeds appear, it must be hand-hoed and hand-weeded a second time, and even a third time, if necessary; when this is done, great care should be taken not to tread upon the young lucern. And as soon as it begins to blossom, it should be mown, carried off, and given to the stock green. By this mode of application, it will, he says, keep more stock than any of the other grasses.

This plant also requires three years in coming to perfection; hence the propriety of sowing common red-clover along with it. After that time, it may be mown three, four, or five times in a season. But, between every mowing, it should be well hand-weeded, and made quite clean of weeds. And every third year it should have a covering of rotten dung, after the rate of eight or ten tons to the acre, applied over it about Martinmas.

Burnet is a grass of the artificial kind, of which there are several varieties; but the only one worth cultivation in this country is the common sort. This plant, though little cultivated, is highly valuable either green or in hay for horses and cattle, and is an excellent winter-food for sheep. It delights most in a dry, clean, light and deep soil; but it will grow very well on poor, gravelly, and chalky soils, which must be made clean and fine by culture.

It is advised by Mr. Amos, that, "about the middle or latter end of July, the land should be ploughed for the last time, and harrowed well: After these operations, four pecks of seed should be sown broad-cast upon every acre, and then bush-harrowed and rolled. And it is suggested, that as the proper season for sowing it is the latter end of July, it becomes an excellent succedaneum to turnips, when they have been destroyed by the fly, which is often the case."

It is, however, stated, that "the most profitable way of cultivating burnet is by sowing it with other seeds, when the land is to be layed down in these proportions:

Burnet-seed - -	1 peck
White clover - -	10 pounds
Trefoil - -	4 ditto
Vernal-grass - -	$\frac{1}{4}$ peck
Ray-grass - -	1 ditto
Crested dog's-tail -	$\frac{1}{4}$ ditto
Sheep's-fescue - -	$\frac{1}{2}$ ditto

The land should be bush-harrowed and rolled, and afterwards kept clean of luxuriant weeds. It is, however, remarked, that "much as this has been extolled, yet it is seldom sown either alone, or with other grass-seeds, since the introduction of red and white clover; though its greatest excellence is for winter-pasture in the feeds of sheep, &c."

Chicory is likewise a plant of this description, which may be found highly beneficial on many poor sandy or gravelly soils, where other sorts of grasses cannot establish themselves. Is is asserted, in the Norfolk Report, that "Mr. Bevan sowed an acre of poor land, worth not more than 2*s*. 6*d*. rent, with chicory in 1793, and that the next year it produced 7*l*. 10*s*. in seed." And, the writer says, that he has taken several opportunities of recommending this grass in that district. On large tracts of poor land, there, he is confident, it would increase the produce ten-fold; and it well merits trial, he thinks, on every soil in it. The objection which has been founded on its not being easily extirpated, is, he contends, of no importance, for tares should be sown after it on some soils, and turnips on others, in which system, its distinction is unquestioned. This hint should not slip the notice of cultivators in other districts.

The summer-tare is a plant of this kind, which is much employed as summer-herbage, either pastured or mown green, as soiling for horses, &c.; for hay, as a substitute for red-clover (on land that has been tired of growing it); for manure to be buried in by the plough; and for seed: hence the season for sowing the seed of this tare will depend upon the use it is intended for. When for summer-herbage, &c. it matters not how early the seed is sown, provided no hard frost ensue. The first sowing may be as early in February as the season and condition of the soil will allow, and to continue the sowing at due intervals through the months of March and April, which will give a good opportunity for successions of them, to the great convenience of summer-feeding. But when for depasturing, it will be prudent to wait till the tares have gained a sufficient increase of haulm, before the stock are turned in upon them. And when for soiling horses, &c. they should be mown before they flower; and in no instance should the haulm be suffered to become rotten near the surface of the ground, which frequently happens on rich soils and moist seasons. If for hay, as a substitute for red-clover, the seed should be sown as early in March as circumstances will allow; but the time of mowing is more optional. Some mow them when the blossoms are fuller; others, just before they are quite ripe. But, in either case, the same caution is necessary, as in making saintfoin and clover into hay; and that is, to avoid breaking off the leaves, in which a great part of their virtue resides. When they are intended for manure, the seed should be sown as early in February as the season and condition of the soil will permit, and at the rate of four bushels to the acre. For this use, they should be ploughed in, before they get too long.

But whatever is the intended use in cultivating this tare, the preparation of the land is the same; and

this plant delights most in light sandy soils: and, in every case, the land should be ploughed and harrowed once in a place, before the seed is sown; then sow the seed broad-cast at the rate of three bushels an acre for the first and second uses; harrow the land well afterwards, and then lay it dry.

It is stated, that "the great objects in cultivating this tare are, 1st. Spring-food and summer-herbage for cattle and sheep, especially ewes and lambs. 2d. Hay, as a substitute for red-clover. 3d. Manure to be buried in by the plough. And 4th. Seed. But whatever is the intended use of this tare, August and September is the prime season for sowing the seed of it. As soon, therefore, as the ground can be cleared of its crop, the land should be ploughed and harrowed once in a place before the seed is sown upon it."

It answers extremely well simply as a spring-food, when sown with rye, in the proportion of six pecks of each to the acre.

Crops of this sort should never be neglected. See *Artificial Grasses*.

Grass-*Husbandry*, that sort of husbandry that relates to the management of such lands as are kept in the state of grass, and which chiefly consists in the proper application of manure, the pasturing, shutting up, cutting, and preserving of the crop, &c. See *Meadow*, *Pasture*, *Manuring*, *Mowing*, *Hay-making*, and *Stacking*.

Grass-*Land*, such land as is for the most part kept in the state of grass. The descriptions of land most proper for this purpose are, according to Mr. Davis, as stated in his useful paper in the third volume of Communications to the Board of Agriculture, First, lands near large populous towns, where manure is cheap and plenty, and where the produce of grass land is always in demand, and consequently dear. Secondly, lands situated near rivers or brooks, that may be improved by irrigation to a much greater value than can possibly be done under any other mode of culture. Thirdly, lands lying in the valleys of mountainous countries (particularly chalky soils), where old meadow land is scarce and valuable, and the greater part of the arable land is of that nature, that it is next to an impossibility to convert it to good grass-land. And, fourthly, all cold, strong, grass-lands, which, if ploughed up, would be inapplicable to the growth of turnips, and to the general purposes of modern husbandry; and which, under the best system of wheat-husbandry, would not be so valuable as they are now in a state of grass.

As the difficulty of forming grass-land is different in different cases, in some parts of the kingdom this being commonly and easily done, the land having a natural tendency to grass when left unploughed, will revert to pasture without labour, expense, or even seed; while in others, all the art of man has been found insufficient to make good grass-land. After twenty years' fruitless expectation and expense, the land-holders have frequently been obliged to restore the land again to a state of tillage. The great difficulty is therefore, Mr. Davis says, to discriminate what species of land is proper for grass, and what is not. The best meadow-land does not always make the best tillage land, nor does the best arable land always make the best pasture, but frequently the reverse. To make this discrimination, it is necessary, he thinks, to consider well the process of nature in propagating and perpetuating grasses. The great object of nature is, he remarks, to perpetuate all her species; but upon the plants created for the support of animals intended for the food and use of man, she seems to have bestowed more than ordinary care. Different kinds of animals propagate in different modes, some oviparously and some viviparously. Plants having no locomotive motion are endowed with a power of propagating in both modes. In trees and shrubs, and many kinds of plants, the assistance of man is required to obtain viviparous production, by grafting, budding, &c. But, in grasses, nature does her own work, and that in both modes. We have only to attend to her examples, and we shall seldom err. In trees and shrubs, the bud is the viviparous production; in grasses, the root performs the same office. Grasses are as much the offspring of roots as of seeds. Every new root contains the germ of a future plant; and, as the seed-stalks of grasses must necessarily be frequently cropped by animals, nature makes up the deficiency by an increase from the roots. Most of the best grasses are in their nature biennial; but nature, by giving them the power of propagating by the root, has in effect made them perennial: a much more certain mode of propagation than by seed, as being increased instead of being injured by the biting and treading of animals, and by the produce being perfect in one year instead of waiting two, as in the production by seed. But this process does not go on successfully, unless the land is peculiarly apt for the production of grasses. If it is too wet, the grasses will be injured in the winter by rain and frost, and will soon be superseded by rushes and other aquatic plants: if too dry, they will be killed by the summer's heat, and give place to mosses, fern, heath, &c. No land will, he conceives, make a good meadow, unless it is deep enough to admit the roots of grasses to run down out of the reach of the summer's heat, and that it be retentive enough to hold water just so long as to produce fermentation, with such an absorbent understratum as will drain it before putrefaction takes place. Some proportion of grass-land should always be attached to every farm, in order that a proper and suitable supply of winter and summer food may be provided for such animals as may be requisite in managing them, and also that adequate proportions of good manures may be raised; as, where this is not the case, it is impossible that farms can be well managed.

On all sorts of grass-lands, it is of much consequence to keep them as clear and free as possible from the growth of all sorts of coarse plants, those of the aquatic kind being removed by suitable drainage, and the application of different substances of the absorbent description to the surface of the land. They should likewise be carefully eradicated from the hedge-rows of grass-fields annually, and by that means be prevented from spreading themselves over the ground by their seeds. By this practice the

hedge-plants would also be greatly benefited. These sorts of lands should also be kept as clear as the nature of their application will admit, of all kinds of obstacles that impede the production of perfect sward, such as the growth of moss on their surfaces, and the continuance of cattle dung-hills, ant and mole hills, as well as those of sticks, stones, and other similar substances. The proper methods of removing these have been noticed under their particular heads, and in speaking of meadow-lands.

In Hertfordshire, according to the Agricultural Survey of that district on harrowing, with a view to destroy moss, no benefit has been found to be produced, though the mossy material has been well torn up. It is advised that manure should be laid on at the same time: but that where ashes are spread out over the surface without harrowing, the moss plant is destroyed, and the grass greatly improved.

In other cases, much advantage has likewise been experienced from the application of fine sand over the sward, in an even but not too thick a manner.

The dung of animals should never be suffered to remain any length of time in heaps upon the surface of grass-lands, without being bet out small, and dispersed over the surface; as, wherever that is the case, the sward in the places becomes tender, and the grass comes up coarse and in tufts, which are not eaten by cattle stock, and of course much injury sustained.

With respect to the prevention of the rising of ant-hills on grass-lands, they may be in a great measure, if not wholly, guarded against, by having recourse to frequent heavy rolling; as in the rolling down of ant-hills, instead of cutting them up, in an experiment made by the Duke of Grafton, it was found to be attended with complete success, on a large pasture which had been very much infested with ants, and which they had almost covered with hills. But in such cases the rollings should be performed both in the autumn and spring seasons, when the lands are in such state of moisture as just to admit the impression of the roller without receiving injury from the feet of the horses; as, where such operations are executed when the grounds are in a state of considerable dryness, the benefits are comparatively small. The beneficial effects that are produced in this way depend much upon the degree of consolidation that is effected; as it is only by this means that the insects can be prevented from carrying on their operations; a certain state of lightness as well as fineness in the mould being essential to the execution of their labours in a perfect manner.

Besides these, attempts have been made in other ways to prevent the formation of these hills. For as it has been seen that "the economy of the ant requires the situation and soil to be dry, light, and friable, in order to carry on their works, it is probable that, in lands that will admit of the practice, it may be an easy and convenient method of destroying them, and preventing the bad consequences which their labours produce on the surface sward, to conduct water over them; and thus, at the same time, exterminate the colonies of ants, and irrigate the ground; by which two improvements may be effected at once,—the land being cleared from ant-hills, while its fertility is considerably increased." And the use of night-soil, in combination with various sorts of earthy matters, has been advised with the intention of destroying such insects; but this is probably a practice that can only be depended upon in slight cases. See *Ant-hill*.

On stiff yellow clays, a Hertfordshire farmer has found the practice of draining, according to the Essex mode of carrying off the surface-water, useful, though this practice is totally unused by his neighbours in the same parish. Experience has convinced him, that dressing a cold tenacious clay not previously drained is an absurd waste of time, money, labour, and every thing most valuable. Having obtained a tolerably dry surface, his next object (with meadow-land) is to deepen the staple of the soil, and this he does by every kind of compost carried on it for two or three years together, which he finds establishes a better sort of grass than dressing once in three years.

He suggests, that the custom of feeding the first year, instead of mowing, is a practice that must be preferable or not according to the nature of the soil, and the object of converting it into grass-land. With respect to the former, he has found, that if he was to allow even the treading of sheep the first year after the grass-seed is sown, he should fill the surface with receptacles for water, and should have very little, if any, grass of a coarse quality, notwithstanding his drains; because the sheep or cattle would press the clay soil so close, that the water could not penetrate into them; whereas, if he shuts up his field, suffering the grass to stand till it sheds the seeds, he finds the following season that he is enabled, by giving only a slight dressing, to cut a good crop of hay.

In cases of old worn out thin patches or mossy grass-lands, the practice of scarifying or cutting the surface sward, in different directions, by implements for the purpose, has been lately advised as very beneficial in promoting their improvement, especially where they are afterwards manured, and have suitable grass-seeds sown over the thin or patchy parts, as in this way the grass-plants become more strong and vigorous.

In performing this business, Mr. Amos has advised the use of a machine for scarifying and dressing grass-land, whether it is to be mown or depastured with animals. And he conceives that the best time of performing this operation, is from the middle of February to the middle of April. And that, in general, dressing the land one way is sufficient: but, if the sward be very mossy or adhesive, it should, he thinks, be dressed length and cross ways, cleaned, and then rolled, the coulters of the implement being occasionally cleaned.

He suggests, that if the sward be thin, it may be thickened very much by laying eight or ten tons of rotten dung, and sowing seven pounds of white clover, four pounds of wild or cow-clover, four pounds of trefoil, four pounds of rib-grass, and one peck of best rye-grass seeds, per acre, previous to its being

dressed or bush-harrowed, and then cleaned and rolled. He thinks, that by dressing land in this way, moss is torn up, ant and mole-hills levelled and destroyed, the roots of the grass cut and horse-hoed, which causes them to throw out fresh lateral shoots or stems, the sward thickened, and the surface made so clean as to put on the appearance of a perpetual spring when close fed down. And that, by such management, and grazing as much stock as will keep the grass in a young succulent state, and hobbing or mowing all the tufts and weeds three times in the course of the summer, the grazier will be enabled to receive every benefit from his land, and likewise prevent the stems of several grasses from running into seed, and being thereby injured.

Another method of improving grass-lands, practised by Mr. Salter of Norfolk, is said to be original, and of great importance. It is stated in the Survey of that District, lately published, that "upon his large farm of above 800 acres, he found 3 or 400 acres of old meadows entirely poisoned by springs, which, from every sort of impediment that neglect could cause, had formed bogs and moory bottoms, famous for rotting sheep and miring cows; with blackthorns and other rubbish spread over large tracts. His first operations were, to grub and clear the land, and open all ditches to the depth of four or five feet, and to cut open drains in almost every direction for laying them dry; burning the earth, and spreading the ashes on the ground: so far, says the reporter, all was no more than common good husbandry; but he applied a thought entirely his own: as he found that the flinty gravel, marl, and other earths, but especially the gravel, was very beneficial to the herbage, he thought of sowing winter tares and white clover upon the places wherever any earth was spread, or any other operation had laid bare the surface, harrowing in those seeds. The writer had the pleasure of seeing several of these crops growing: the success has been uncommonly great; for the land thus sown not only has given large and very profitable crops of hay, but has also received a rapid improvement in the herbage; the cover and shade of the tares, so beneficial to all land, mellowed the surface, and seemed to draw up as well as protect such of the old plants as received improvement from the manure, and exhibited a much superior fleece of grass to any spots where this singular management had not taken place. So that nothing can be clearer, on viewing this large tract of meadow, than the superiority of the improvement resulting from the growth of the tares: the effect of the manure is much accelerated and rendered greater."

It is suggested by the reporter, that "the idea is certainly applicable to many of the grass-lands of the kingdom, especially such as are improving by the addition of chalk, marl, clay, loam, sand or gravel: 40 loads an acre of any of these bodies will much improve coarse or wet, or moory grass-lands; and then to add tares secures an immediate profit, and makes the manure work much sooner and more powerfully. He sows some so late as the middle of May." An idea here strikes the writer, which he shall venture to add; that "if he was to scarify any mossy, hide-bound, or poor pastures, &c. it should be with a drill-scarifier, drilling in winter tares by every tooth of the scarifier; and he has no doubt but the tares would take well, and effect a considerable improvement, even without manuring." It is added, that "Mr. Salter has practised the tare husbandry on meadows for ten years, but his first beginning was seventeen years ago, at Ellingham: the cockchafer-grubs had destroyed a part of a meadow; he harrowed in tares and seeds, and the success was great." It is further stated, that "tare-seed running short, he this year sowed peas and oats mixed on some spots, and they are found to do well; and this husbandry he pursues, whether he intends mowing or pasturing. The writer considers this a discovery of vast advantage to grass husbandry.

In the same work, it is likewise observed, that "Mr. Bevan's arable sand, at Riddlesworth, joining to his low boggy meadows, gave him the power of carting sand down hill at an easy expense; and thus he improved some parts of those meadows to great effect: from 100 to 150 loads an acre were spread at the expense of *4l.* or *5l.*

	£.	s.	d.
A team of five horses, 30 loads a day, and wear and tear - -	0	12	6
Driver - - -	0	1	6
Filling, at *2d.* - - -	0	5	0
	0	19	0

1802. It has answered very greatly: these meads were then not capable of irrigation, but one meadow has since been watered, and the water has taken much greater effect on account of the sanding, than if that operation had not been performed. The sand has all been laid on the most boggy meadows." This hint should not escape the notice of the practical farmer in other districts, as there are many where it it may be had recourse to with the greatest advantage.

And a similar method of improving old rough and boggy meadow-land has been described, with a plate, by a writer, under the title of Agricola Norfolciensis, in the first volume of the second series of the Agricultural Magazine, as practised by Mr. Rix, of the same county. "This meadow was situated at Clipstone, near Fakenham, in the occupation of the above, and the property of T. W. Coke, Esq."

It is stated, that "this meadow, from the neglect of former tenants, and want of judgment in cutting what few open drains or ditches were attempted, had become very rotten in many places, and at least three parts of the four so over-run with sedge and rushes, that its utmost annual value could scarcely be estimated at more than eight shillings per acre. The lands contiguous to it, are of a light friable nature, inclining to sand, by spots, and fall with a gentle declivity towards it from each side, the meadow being the bason and receiver of the numerous springs which rise in the upper fields, and which in a course of time had rendered some parts

of it utterly impassable for an horse, and scarcely safe for a man at certain seasons.

The first step the present occupier took was, as soon after Michaelmas as he could, to cut the drains, as he has shewn in the plan; all of which are covered, except the main drain, and the two ditches. These latter are cut both wide and deep, and are the chief operating checks to the springs above.

As soon as the weather permitted, he next set the teams to work (which were enabled to enter, even upon the most unsound parts, very shortly after the first process was concluded), to level the hills, fill up the hollows, and to cart all the superfluous mould he could collect within the boundary of the meadow, (such as came out of the new-cut ditches and main drain principally), to the amount of 1000 loads, over the surface of the whole.

In the last week of March he drill-rolled; and where the roller could not work, from little inequalities of ground, he dibbled the seeds mentioned in the annexed statement, harrowing the small seeds in afterwards; and, in July last, he cut and stacked the produce, which the writer has seen, and can witness to be excellent hay.

The present appearance of the meadow, after being fed down very close by more than fifteen score sheep, exhibits, notwithstanding the very wet season we experienced, one uniformly dry, firm, and smooth surface, completely covered with a short turf, consisting of ray-grass, Dutch-clover, and good natural grasses. There are certainly some rushes yet, but far less numerous and strong than heretofore, and which it may justly be expected a few sweepings with the scythe, and hard stocking with sheep, will in time wholly destroy.

Although there may not be much novelty in the scheme of draining, the writer is of opinion, that very great merit is due to Mr. Salter, for the introduction of vetches, which he apprehends was never before tried on pasture-grounds, or indeed on any ground whatever unbroken by the plough. It certainly answers several admirable purposes, one is, that it gives a prospect every year of a bulky crop of hay, which otherwise must have been very scanty. And being sown with oats, the vetches afford that hovering kind of shade and protection to the young grasses in which they most delight. The eddish is of course of more worth also.

He is not quite sure, whether Mr. Salter's experiment gave rise to the following practice, which he is informed daily gains ground: Where the clover plants fail partially, or by spots, on a new layer, spring vetches are often drill-rolled upon the surface not ploughed. The few clover-plants are thus left to grow with the vetches, and both together in due season, form nearly as good a swath, as if the clover had not died away.

Mr. Rix is so thoroughly convinced of the utility and advantage of the method he has pursued, that he is now preparing a second meadow, lying at the foot of the one just improved, for a similar process.

Where pasture-land can be spared for mowing, Mr. Salter seems to be of opinion, that vetches may be profitably employed, even a second year, upon new improved meadows. He has had some experience of such a repeated trial, and the writer believes he thinks favourably of it. He dibbles the seed upon the unbroken surface, after feeding it down as close as he can with sheep.

The above meadow of Mr. Rix's cannot, he thinks, be over-rated, if he says that it is, at this moment, more worth thirty shillings per acre to a tenant, than, in its former state, it was eight shillings.

Debtor and Creditor Accounts of Mr. Rix's Meadow, ending at Michaelmas.

1806.

	£.	s.	d.
363 of open drains, at $9\frac{1}{2}d.$ -	14	6	3
173 under drains, at 6*d.* - -	9	6	6
700 alder faggots, laid in drains -	5	12	0
Filling and spreading 1000 loads of mould, at 25*s.* per hundred - -	10	0	0
SEED.			
6 co. sp. tares - - -	6	6	0
6 bushels of grey peas - -	1	2	6
6 do. of oats - - -	0	16	9
2 do. of ray-grass - - -	1	10	0
100 pounds of Dutch-clover -	3	15	0
Dibbling - - -	1	8	0
HORSES' TIME.			
5 horses 14 days, setting about mould	7	0	0
4 do. drill-rolling, 3 days - -	1	4	0
2 do. bushing and rolling in seeds, 3 days	0	12	0
MENS' TIME.			
1 man driving team, 14 days -	1	8	0
2 men drill-rolling, 3 days -	0	12	0
1 man bushing, 2 days - -	0	4	0
1 do. gathering stones, 2 days -	0	4	0
Total expense	65	6	0
PRODUCE.			
18 loads of hay, at 4*l.* - -	72	0	0
Feed - - - - -	13	0	0
	£ 85	0	0

Care must also be taken to keep grass-lands in a proper state of production, by the judicious use of top-dressing, and by observing suitable methods of mowing and feeding them.

It becomes of course necessary, in the view of keeping such lands in the most proper condition for the production of plentiful crops, as well as that of altering and improving the nature of the herbage, to have recourse to the occasional application of manure; as by this means the staple and depth of the

vegetable mould are not only much increased, but the land brought into such a state of fertility as that it may afterwards be kept up with much less expense and trouble.

It has been observed by a late writer, that "it is a circumstance well known to grass-farmers in the best cultivated districts, that when lands of this sort are suffered to get much out of condition, it is a much more difficult business to restore them to the proper state of productiveness, than to preserve them in it. From the constant decomposition and decay of various vegetable materials on the surface of grass-lands, new portions of vegetable mould are constantly added, that improve the quality of the lands, and at the same time afford a more suitable and fertile bed for the establishment of the different kinds of grass-plants. It is chiefly, perhaps, on these accounts, he thinks, that old grass-lands are superior to new ones, and it explains the reason of the greater utility of earthy composts with dung in the latter than the former cases. However, with respect to the most proper periods of making such applications, there is much difference of opinion; but it should, probably, be regulated by circumstances; such as the state of the land in regard to dryness, its situation, the heat of the season, and its nature and condition in respect to soil and ferlity. Where the land is such as not to admit the dung-cart in the early spring months, without the danger of injuring the surface by poaching or breaking the texture of the sward, the most proper period would seem to be in the beginning of the autumn, before the heavy rains fall, as at this period the dressing may be laid on with the greatest convenience and safety; and from the after-grass being chiefly consumed with the least loss in that particular. It is, however, recommended to be performed by some, immediately after the land has been mown and cleared from the hay, in which method there may be an advantage in some cases, as the growth of the after-grass may thereby be rendered more abundant." While, in other respects, it has been observed by the author of Practical Agriculture, that, "it must often be not only inconvenient, but uneconomical, as, from its happening at a season when much other business is to be performed, it can seldom be attended to in such a manner as is necessary; and when the season at this period is hot, and there is much sun, as in general is the case, there must be considerable loss sustained in the extrication and dissipation of the finer and more enriching particles, such as become more immediately the food of plants, from their being in a condition nearly suitable for being absorbed and taken up by the roots of the grasses. The extent of the loss incurred in this way is much, he says, more considerable than is commonly supposed, as must appear evident from the great exhalation and constant evaporation that is often kept up for many days, or even weeks, as the very offensive smell that issues fully proves. In this district, says he, where we have occasionally witnessed the practice, with some of the less intelligent farmers, the moisture of the manure has been so much forced off and dissipated, especially when there is much wind, as to leave the materials in nearly a perfectly dry state. The sudden drying up of large ponds, at such seasons, shows in a more striking manner the extent of the injury that the farmer sustains in choosing this season for the application of his manure" upon his grass-lands. And, he states still further, that "there is another way in which a vast loss of manure may take place when applied at either of the periods that have been just noticed, especially where the lands lie in sloping directions, as is frequently the case, which is by the heavy rains in the autumnal season carrying down the more fine and rich parts of the manure, in a state of solution, into the ditches and runlets on the sides or other parts of the fields. Of the great waste of manure occasioned in this way any one may convince himself, by attending to the state of the water as it drains off from the higher grounds into these places, after the land has been previously dressed, as it will be found highly coloured, and loaded with the enriching carbonaceous particles of the manure." And "after frosts, when sudden thaws occur, the same thing happens" in a still more extensive degree.

Where the natural dryness and open texture of the soil admits of the manure being applied in the early spring months, there will be less danger of waste in the above manner, and at the same time greater advantage obtained in the growth of the produce; as, from the moderate heat and quickness of the vegetation at this period, the grass will soon over-shade and conceal the dung, where laid on in a suitable state of reduction or fineness, without suffering much exhalation to take place; and the enriching material be conveyed to the roots of the grass-plants at the time in which it may be the most useful in promoting their growth. Where the principal object of the farmer is a large produce, and the nature of the soil will admit of the manure's being applied without injury, this is unquestionably the most suitable as well as most beneficial time of putting the dung upon grass-lands. The earlier, however, it can be performed the better.

It has, however, been stated by Dr. Wilkinson of Enfield, that manure, in his experience, produces the strongest effects upon the land when applied early in the autumn, or in meadows as soon as possible after they have had the hay taken off from them. And the Rev. Mr. Young supposes this last as the most proper season for having the business performed in.

With regard to the kinds of manure that is most proper, there is scarcely any sort that will not be beneficial when laid upon grass-lands: in general, however, the more rich animal kinds will be the most suitable for the older sorts of sward-land; and dung, in combination with fresh earthy materials, the more proper on the new lays or grass-lands, as by this means a fine earthy bed will be prepared for the roots of the grass-plants to shoot and spread themselves into, and a better sward formed in consequence of it. See *Laying Land down to Grass.*

In the grass districts about Hendon in Middlesex, it is the practice of the best farmers to use the richest dung they can procure, without mixing it with any sort of earthy material, as they find it answer best in the quantity of produce, which is the principal object. The lands on which this system is pursued, are mostly such as have been long under sward, and where the soils are chiefly of the more tenacious, loamy, or clayey kinds. It cannot, however, be doubted, but that earthy composts in the proportion of a third or fourth of such materials may, in many cases, according to the nature and circumstances of the land, be had recourse to with great and beneficial effects, both in rendering the land more productive, and in bringing the herbage into a finer state, as well as in bettering the surface for the scythe. See *Manure.*

Whatever the nature of the material may be that is employed in combination with dung, or the sort of manure that is used, it should invariably be brought into a rather fine state. It is the practice, in the district mentioned above, to turn over the dung that is brought from London in a state of tolerable rottenness once, chopping it well down in the operation, so as to be in a middling state of fineness when put upon the land. It is necessary, however, that it should be in a more rotten and reduced state when applied in the spring, than when the autumn is the time of putting it on.

The proportion of manure made use of at once should be, in some measure, suited to the state of the land, but, in general, such as to afford a good even covering to the surface of the ground. Where the manure is of a very good and enriching quality, the quantity may be from four or five to six or seven loads on the acre, of such as are drawn by three or four horses. But where the manure is of an inferior quality, a much larger proportion may be requisite.

With regard to the frequency of dressing grass-lands in so far as it respects the soil, it should constantly be performed at such distances of time, as that the fertility of the lands may not be suffered to decline, but be preserved in an equal or increased state of heart; in which the manner and frequency of cutting, or otherwise consuming the produce, must be considered; as, where crops are more frequently taken off, the land must be prevented from being injured, by the great loss of fertility that must arise in this way, by the dressings being applied at shorter intervals, or in larger quantities at a time; but the first is by much the best method, as injury may often be done by too great a dressing being given at once. But, in general, where such lands are in a tolerable state of cultivation, every third year may be sufficient; while on such as are of inferior value, it may be a better practice to do it every second year, as by this frequent application of manure, the lands may attain a gradual improvement; whereas, in the contrary case, they would be on the decline, and in time become poor and worn out to the great injury of the farmer. It is a too common practice, in districts where grass-husbandry is imperfectly understood, to almost wholly neglect the manuring of sward-lands, in order to employ it on those which are under the plough: but this is obviously bad management; as it is only by the raising of full crops of grass for being converted into hay, and of proper kinds of green food, that a full stock of cattle can be kept, and the largest possible proportions of manure provided.

There are a few articles made use of as top-dressings to grass-lands, which cannot, it is said, be frequently repeated with either safety or advantage, such as chalk, marl, chopped woollen rags, and others. It is observed in a late work, that "the first of these kinds, especially when of a soft unctuous nature, so as to readily fall down in the state of solution to the roots of the grass-plants, is found to produce the most beneficial effects, in rendering the lands more fertile and productive, and improving the quality of the herbage. It cannot, however, be often repeated in its simple state with advantage, as it is some time in producing its full effects; but in that of compost, it may be applied with success at shorter intervals. Marl is likewise a substance, especially when it is of the rich soapy kind, that may be made use of with much advantage as a top-dressing on grass-lands; but as its operation is slow, it cannot be repeated at short intervals, except when employed in the state of a compost with dung. Woollen rags, when rendered small by being chopped into pieces, may be laid on land in the state of sward; but as they require a considerable length of time to sink down and become mixed with the soil, so as to be well covered by the grass, they cannot be repeated at short intervals. After they have been fully incorporated with the land, their beneficial effects are considerable," as have been fully shown in the trials of different grass-farmers.

In addition to these, there are various other matters that are occasionally applied as top-dressings on grass-lands; such as lime in combination with rich vegetable earth or peat, the ashes derived from the combustion of peaty substances, coal-ashes, malt, dust, and soot.

These have been made use of with good effects when thinly spread out over the surface swards of lands in the state of grass. The three last have been found to produce the best effects in being dispersed over the new lays of the artificial grass kinds. All applications of this sort should be applied in February, being spread over the surface as evenly as possible. "If it can be done before a shower of rain, it will be the better, as it is of advantage to have them carried down to the roots of the grasses as soon as possible after they are laid upon the land."

But Mr. Young advises, in the "management of purchased manures, that experiments should be formed for a year or two, before the practice is extended, to see which, at a given price, will suit the land best. Without this precaution, a farmer may probably expend large sums of money to little purpose. Nor would he advise him to trust to the mere appearance of the effect soon after the manuring; for some of them, particularly soot and malt-dust, will

shew themselves after the first heavy showers, in a finer green than the rest of the field; but the proof of the effect does not arise from fine greens, but from weight of hay: for he has found from experience, that the latter is not always an attendant on the former. Contiguous half-acres, or roods, should be marked out, the prices of the manures calculated, and on each piece a separate one spread, all to the amount of 20*s.* an acre, for instance. At hay-time, the crops should be weighed. It will then be known which manure, at the given prices, suits the soil best. This knowledge will, he says, prove true experience, and a very different guide from general ideas."

There is another circumstance necessary to be attended to in putting manure upon lands of this kind, which is not to suffer too much to be placed out in any of the heaps, but to have them set out as much as possible in moderate sized portions, and "at regular distances from heap to heap; as, where the coutrary is the case, it not only takes up more time, and causes much more trouble to the labourer in spreading them, but does not admit of the work being performed in so regular or so exact a manner. Besides, when the heaps are set out too large, more injury is done to the grass-plants on the surface where they stood, if not soon spread out, which should always be the case" as much as possible.

It is of much consequence, in the execution of this business, to have convenient carts for the purpose, which, in general, are those of the single-horse kind.

There is likewise care necessary in the scaling or "spreading-out all sorts of top-dressings on grass-lands, to see that the work be performed in an exact and even manner, and that all the clods and lumps be well broken down and perfectly reduced by beating with the fork or shovel. If possible, a dry season should be chosen for this sort of business, as, under such circumstances, it can be executed in the most regular and exact manner; as when the weather is wet it is an operation that can never be well performed, as the materials clog round the feet and implements of the workman, and can never be effectually separated or divided so as to be spread out with the necessary degree of evenness." It has been observed, that "after the heaps have been set out, they should not be suffered to remain so long, as is often the case, before they are spread out, as the plants underneath them become blanched and tender, and great injury is done to the sward in such cases, all of which may be easily avoided by spreading as soon as possible after the manure is taken out. Inconveniences of this sort may likewise be avoided by spreading the manure from the carts, as is the practice in the midland and some other districts: but in this method it is suspected the work can neither be executed in so exact a manner, or with so much economy of time to the labourer. In this way hill-steads will not however be formed, and, of course, the disadvantage of their getting too large a proportion of the manure prevented," as Mr. Marshall has well observed in his Rural Economy of the Midland Counties.

It is the usual practice, as soon as "the whole has been spread out, and remained in that state for a fortnight or three weeks, or longer, according to circumstances, and is become in some degree dry and powdery, to apply a bush-harrow over the surface once or twice in a place, in order to reduce the manure into a fine state, and bring it more fully to the roots of the grasses. But this sort of work, as that of spreading, should never be attempted when the season is wet, and the manure in a claggy adhesive state. As soon as this work has been executed, all the rubbish of every kind should be carefully picked off, in order that the ground may receive the action of the roller," which should be passed over it as frequently as may be thought necessary, when the land is in a suitable condition for receiving it. See *Rolling*. This is the principal business which is requisite in the management of grass-lands.

It is stated in the Survey of Herefordshire, that "a mode of managing sound meadows and pastures has lately been tried, and attended with great increase of produce. The grass is mown as soon as it is in blossom, and consequently previous to the formation of seed. The after-grass is not grazed until it begins to contract a yellow appearance, in the latter end of October or the beginning of November. In this case, the ground remains covered during the winter with a portion of dead herbage, through which the young grass springs with the greatest vigour. Mr. Knight contends, that the sap in all plants ascends through the alburnous vessels of the root, and is dispersed over the leaf, whence it is returned to form new roots and buds, and to prepare them for vegetation. According to this theory, if the leaves be eaten off on mowing ground, as soon as they are reproduced, the roots are deprived of their nutriment, and the plants in consequence vegetate weakly in the succeeding spring. Whether this hypothesis be well or ill founded, it is certain, the writer says, that the ground which is left with this portion of the leaves of grass in the one season, is much more productive, and more early in the next; and close grazing will ever be found to decrease the quantity, although it should improve the quality, of the following crops."

That there is some truth in this we are well convinced, from having found that the crops are more early and abundant in different cases, where the after-grass is not fed down much in the autumnal season. See *Mowing* and *Grazing*.

In respect to the difference in the proportion of human food raised from grass and tillage land, the first circumstance necessary to be attended to, according to the Rev. Mr. Young, is that commonly denominated *Price*.

But these inquiries suggest a further idea concerning the part of the produce, of either grass or arable land, to which that circumstance is attached. It is evident, on the slightest view of the subject, he says, that the portion of the produce consumed in the farm-

er's family can have little to do with the price of the market: it never finds its way thither: it never comes to be measured with the demand of the consumer; who does not produce. For this reason, in all inquiries that have for their object what is called plenty or scarcity, we never, he says, hear of any thing but price; and price is never formed but by the supply of towns from the produce of the country. The larger part of a modern society consists of the inhabitants of those towns, who are supported either by manufactures, or on incomes not derived immediately from the cultivation of the earth. So much, says he, for just opening our way in a field rather interesting: but may we not, with equal propriety, extend the circumstance just alluded to, to the labouring families supported by the farmer? His little neighbours in the village, who do the work of his husbandry, arrest, if he may so express it, the amount of their subsistence from the crop before it arrive at the market. They must be fed; and though in many cases, by buying their flour of a miller, they seem to class with the inhabitants of a town, yet perhaps in more numerous cases they are, in fact, fed immediately from the farmer's stores; and in effect always so: for, if the farmer cannot produce his crops but by their direct assistance, and must multiply them exactly in proportion to the operoseness of his culture, they cannot be considered in any other light, than mouths attached to the culture of the land, and demanding a deduction from the produce of wheat, before the surplus for market be reckoned, in as direct a deduction as that from his crop of oats for the food of his horses, or other animals. He adds, that there are in the Suffolk Report some estimates of what the writer calls produce free in the market, and he makes the grass-lands yield a greater free produce (horses, labour, &c. &c. deducted) than arable; and he knows not but it may be the same in other counties. Other writers seem also to have had the notion that grass-land is more beneficial than arable. Bertrand, a Swiss writer, says, that grass-countries yield more food than arable, and therefore manufactures should be fixed in them. Hartlib seems to be of the same opinion, and quotes those of Europe as the most populous. Fortrey, who wrote in 1663, also says, that our chief care should be to increase our stock of cattle. There is some degree of truth in these sentiments; and they might be considered in relation to the proportionate nourishment, in a pound of animal food compared with that of a pound of vegetable, which some authors have made vastly greater in meat than in bread. These are topics, it is observed, which ought to be thoroughly examined, that the public mind may be free from every erroneous bias upon such points.

The author further remarks, that in the dairy countries, where butter is the chief produce, four firkins, or 224 lbs. may be reckoned the average produce per cow; the calf sold at about a week old, may contain about 30 lbs of flesh; and as the pigs supported by a dairy used to be reckoned at the rate of 20*s.* per cow, when pork was 6*d.* per pound, it implies, that 40 lbs. of pork is the proportion to each cow: but the cow consuming the produce of three acres, the acreable account would be,

	lbs.
In butter - - - - -	74
In veal - - - - -	10
In pork - - - - -	13
Total	97

But, in the cheese counties, the products vary a good deal: in Cheshire 4 cwt. per cow; in Shropshire $2\frac{1}{2}$ cwt.; in Gloucestershire about $2\frac{3}{4}$ cwt.; in Wiltshire 4 cwt.; in Somersetshire $3\frac{1}{2}$ cwt.; in Warwickshire 3 cwt.: the average of all these is $3\frac{1}{2}$ cwt. and at three acres per cow, 1 cwt. and a small fraction per acre; and as these countries are richer than those applied to the produce of butter, veal may be called 15 lbs. and pork 20 lbs.; in all, 147 lbs. per acre, or thereabouts.

But as to meat, authorities, he says, are not very ample: in the midland counties there is a very general notion that an acre of grass, at 40*s.* rent, will give 200 lbs. of mutton. By an experiment made on land of an inferior quality, which is mentioned in the Annals of Agriculture, land of 16*s.* rent gave 80 lbs.; and he has heard, on good authority, that in Cambridgeshire some observations, carefully made, confirmed this proportion of produce in land fed both with bullocks and sheep; and the produce of beef, &c. in the Lincolnshire marshes, goes even further than this ratio or proportion.

In regard to the butter dairies, they are on land of about 16*s.* an acre rent; and if the produce be 97 lbs. the proportion will be 6 lbs. to every shilling rent. The cheese dairies, at 25*s.* rent, yielding 147 lbs. are also at about 6 lbs. per shilling rent. The meat is 5 lbs. per shilling. It is easy then to decide that dairy countries are more advantageous than grazing ones in weight of produce; but their superiority is far greater in another point of view; their produce comes much more into the consumption of the poor; for, where one poor person eats meat, there are probably forty that consume butter and cheese. How to compare these products with those of arable land is very difficult; and yet the inquiry is too interesting entirely to be omitted: a long train of investigation might enable one, he says, to disentangle difficulties, but it would require much time to go deeply into such a variety of subjects. The produce of a good loamy soil, under the course, 1. turnips, 2. barley, 3. clover, 4. wheat, may, he thinks, be thus calculated:

"No. I. *Arable dry Land at 16s. an Acre Rent, five Acres each Crop; twenty Acres in all, in a Course of four Years' Husbandry.*

	Persons.	Time. Years.	Weeks.
1. Turnips*; eight sheep an acre, at the increase of 5*s.* each sheep, or 40*s.*; in mutton 80 lbs.; and for 5 acres 400 lbs. will be sufficient (at ½ lb. per person † per diem) for two persons, one year and five weeks - - - - - - -	2	1	5
2. Barley and oats; suppose an allowance of 1½ acre of oats (at five quarters per acre) for one horse as the proportionate team to twenty acres, and including seed for 1½ acre: in all sixty bushels ‡; remain 3½ acres for barley, at four quarters an acre; fourteen quarters or 112 bushels; deduct fourteen for seed, remain ninety-eight bushels for malt, &c.: but, if applied in bread, sufficient at nine bushels per head § per annum, for eleven persons a year, minus one bushel.			
3. Clover: deduct two acres for the summer and winter-food of the horse, remain three acres for sheep, at eight per acre, improved 8*s.* each, or 3*l.* 4*s.*; or (at 6*d.* per pound) 128 lbs. ‖ of mutton, and for three acres 384 lbs. sufficient at ½ a lb. a day for two persons a year; and leaving 20 lbs. over; - - -	2	1	20
4. Wheat; twenty-two bushels per acre, which, after deducting seed, leave twenty, or 2½ quarters, and for five acres 12½ quarters, sufficient for twelve persons a year and two weeks - -	12	1	2
Whole produce in human food -	16	1	17
The same land, if in grass, would give 80 lbs. ¶ of mutton per acre, 400 lbs. per annum, and for four years 1,600 lbs.; sufficient at ½ lb. a day to support eight persons one year and thirty-six days" -	8	1	36

But from this result we have, he observes, "to make the deduction, before alluded to, of the farmer's family, and his labourers: suppose he farms an hundred acres, which is, probably, above the average size of farms of the kingdom, here are five persons to that extent, or one to twenty acres. If we reckon all sorts of labour at 21*s.* an acre, we shall, he supposes, not be far from the fact: the pay of a labourer may be reckoned on an average at 25*l.*, which we shall call the food of five persons; setting the earnings of the wife and children against rent, clothes, and other articles; this makes food 5*l.* a head: for every 5*l.* therefore that the farmer pays in labour, we may safely, he supposes, reckon that one person is fed from the produce of his farm before it reaches the market: the labour in the twenty acres in the above inserted estimate being 21*l.* he calls four persons', and the farmer's family one, making five, to be deducted from the acrable amount of the farm."

	Persons.	Years.	Days.
Brought forward -	16	1	17
Deduct - -	5	0	0
Remain for market -	11	1	17
And the 20*s.* excess in the 21*l.* strikes off -	0	0	17
	11	1	0

But "in regard to grass land, as it is managed with so much more ease, and farms are generally so much larger, he thinks it will be fair to deduct only one person for farmer and labour."

	Persons.	Years.	Days.
Brought forward - -	8	1	36
Deduct - - -	1	1	36
Remain for market -	7	1	36

* Turnips fattening eight sheep an acre is a common estimate in Norfolk and Suffolk, and the average improvement in each sheep of 5s. is equally common.

† Merely assumed. It is easy for those who would calculate on a different quantity to do it for themselves.

‡ Fifty-four bushels for the horse, six for seed.

§ The common consumption in the countries where barley is eaten.

‖ It is before stated that natural grass of 16s. an acre rent will give 80lbs. of mutton: clover upon land of the same rent will of course produce much more.

¶ According to the position just laid down with respect to grass-land.

Hence then it appears, he says, that under the circumstances of such land thus applied, arable land, on comparison with grass, sends to market in the proportion of 11 to $7\frac{1}{10}$. But if the barley, instead of being drunk, be eaten in bread, it adds to the arable account eleven persons, and the account would then stand nearly twenty-two to $7\frac{1}{10}$, or about three to one.

He observes, however, that, as the largest part of the kingdom is employed in systems of husbandry very inferior to this excellent one, let us calculate how the comparison will stand with open fields, and those inclosures which are managed by means of fallows in the ordinary rotation of cropping.

No. II. *Open-field arable—Soil clay or wet—Rent* 10*s*. *an Acre, five Acres each Crop; thirty in all, in a Course of Six Years' Husbandry.*

	Persons.	Time. Years.	Weeks.
1. Fallow:			
2. Wheat; produce twenty-two bushels; seed two; for consumption twenty, or $2\frac{1}{2}$ quarters; $12\frac{1}{2}$ quarters for five acres, being food for twelve persons during one year and two weeks -	12	1	2
3. Oats: produce four quarters an acre; seed half a quarter; remain $3\frac{1}{2}$ quarters per acre, or $17\frac{1}{2}$ quarters, or 140 bushels: sufficient, at twenty-five * bushels a head, to feed five persons a year and five weeks, if used in bread.			
4. Fallow:			
5. Barley; supposed to be consumed in beer, &c.: but, if eaten by man, at four quarters an acre, deducting half a quarter for seed, remain $3\frac{1}{2}$ quarters or twenty-eight bushels; and at nine bushels a head, sufficient for three persons one year, and one bushel over, and five acres, enough for fifteen persons one year and two weeks.			
6. Beans; for horses equal to the food of $1\frac{1}{2}$ horse (at one horse to twenty acres) for the year.			
	12	1	2

The same land laid down to grass, and let at 20*s*. will, he says, feed (on the supposition of an increase 5lbs. per shilling rent) oxen and sheep to the addition in weight of 100 lbs. of beef and mutton, or 500 lbs. for five acres, and 3,000 lbs. in six years; which, at half a pound a person per diem, or 182 lbs. per head per annum, will feed $16\frac{1}{2}$ persons a year.

However, the course here detailed does not, he says, feed the horses in summer; but as it affords, perhaps, more horse-food in the beans than to that amount, no other deduction should be made. It appears, he adds, that thirty acres of such land, when the oats and barley are eaten by horses, or drunk by men, support twelve persons a year and two weeks; now from this we are to deduct, as in the former case, the population of the farmer and his labourers; the former in the same ratio as before; but 15*s*. will be enough to deduct per acre in labour, instead of 21*s*. in the other course. This will, on thirty acres, be 22*l*. 10*s*. or $4\frac{1}{2}$ persons a year: add one and a half† for the farmer, it is six in all.

	Persons.	Years.	Weeks.
Brought forward -	12	1	2
Deduct labour and farmer	6	1	0
Remain for market -	6	1	2‡

	Persons.	Years.	Weeks.
The grass - -	$16\frac{1}{2}$	0	0
Deduct $1\frac{1}{2}$ for farmer and labour, that is, one per 20 acres‡ - - -	$1\frac{1}{2}$	0	0
Remain for market -	15	0	0

However, if the barley and oats be brought into the account as human food, the account will then, he says, stand thus:

	Persons.	Years.	Weeks.
Wheat - -	12	1	2
Oats - - -	5	1	5
Barley - -	15	1	2
say	32 for	1	2
Deduct for farmer and labour	6	1	0
Remain - -	26	1	2

In one case, therefore, he says, the grass has the advantage as fifteen to six: in the other, the arable as twenty-six to fifteen.

* Smith, in the Three Tracts on the Corn Trade, calculates at twenty-three bushels: He thinks it safer to allow twenty-five.

† The same proportion as before, one to twenty acres.

‡ This subtraction is of persons only, the time remaining the same.

No. III. *Poor Sand or Heath—Rent 5s.; five Acres each Crop; thirty Acres in all.*

	Persons.	Years.	Weeks.	Days.
1. Turnips: four sheep an acre, to the increase of 6*s.* each, or 24*s.*; in mutton 48lbs.; and for five acres 240lbs.; sufficient, at ½lb. per diem, for one person one year sixteen weeks and four days - - - - -	1	1	16	4
2. Barley and oats; one horse to thirty acres, which demands 2½ acres of oats, at three quarters (seed deducted); the remainder therefore 2½ acres for barley, at 2½ quarters per acre, being sixteen bushels (seed deducted), and for 2½ acres forty bushels remain for malt; but enough in bread, at nine bushels a head for 4½ persons a year, minus one bushel.				
3. Grasses.				
4. Ditto.				
5. Ditto.				
The whole, without any horse account, would feed, 1st. year, three sheep per acre, 26 weeks; 2d two ditto ditto; 3d one ditto ditto to the improvement (or the value in keeping) of 40*s.*, and for five acres in each to 10*l.*: hence it appears that to keep one horse would almost equal the whole amount.				
6. Rye: 1½ quarter; twelve bushels; seed deducted, ten; sufficient to support one person fifteen months; and for five acres six persons one year and eight weeks - - -	6	1	8	0
Within a small fraction equal to -	8	1	0	0
The same land in heath would feed, but not fatten, to the value of 10*s.* per acre; call this 20lbs. of mutton; 100lbs. for five acres, and 600lbs. in six years; sufficient, at ½lb. per diem, for three persons a year and thirty-six days -	3	1	5	1

	Persons.	Years.	Weeks.
Brought forward, arable account	8	1	0
Deduct, as farms on this soil are large, only half a person for thirty acres for the farmer; and reckoning labour at 8*s.* an acre, it is 12*l.* for thirty acres, or 2½ persons; in all three -	3	1	0
Remain for market - -	5	1	0
Grass for ditto - -	3	1	5

A fraction is, however, he says, to be deducted for farmer and shepherd. The difference therefore as five to three. But, if the barley be consumed in bread, the account will be,

	Persons.	Years.	Weeks.
Brought down - -	5	1	0
Barley - -	4½	1	0
Together -	9½	1	0
Grass - - -	3	1	5

The arable is therefore superior as nearly three to one. Upon the whole of these comparisons it is, he thinks, sufficiently clear, that the arable land is, and in every case may be, (by eating barley and oats) far superior to grass-land in the article of feeding not only the people at large, but also in sending a surplus to market. He cannot, however, he says, let his papers go from his hands without requesting them to be read with candour. He presumes to offer them but as rough sketches, that may approximate to truth, but cannot reach exactness: they may afford hints useful to future inquirers, and the subject is interesting enough to answer well a very careful examination. One observation that goes generally to all is too material to be omitted: the production of meat in England is, he thinks, of small importance compared with that of corn, because the poor do not live on the former: meat is the consumption, generally speaking, of those who are in very easy circumstances, compared with the great consumers of corn; nor would the times be much complained of, whatever the price of meat might be, provided corn were at a reasonable price. This is a circumstance which should, he says, be considered as decisive of the inquiry; and sufficient to prove, that the great interests of the public demand every possible encouragement to tillage, so given, as shall preserve corn at a fair price, neither too high for the poor, nor so low as to discourage the cultivation of it.

In regard to what ought to be the proportion between the grass and arable land of a farm, errors are,

it is observed, extremely common among landlords, and not less so with farmers: in general, however, they both look to their own interest; the first to keep much in grass, and the latter to plough all they can: with short leases, and bad covenants, we are not, he thinks, to be surprised at either. One acre of moderate corn, says Adam Smith, in his Wealth of Nations, yields a greater neat profit than an acre of the best pasture. And experience, Mr. Davis, of Longleat, observes, sufficiently evinces the extreme difficulty of persuading tenants to believe that they get more, generally speaking, by feeding their lands than by ploughing them; yet it requires very few arguments to convince a landlord, that in cold wet lands especially, the less ploughed land you have, the less you put it in a tenant's power to ruin your estate. That a tenant of 60*l.* per annum in a dairy-farm will get money, while a corn-farm will starve its occupier (though, perhaps, the former gives 15*s.* an acre for his land, and the other but 10*s.*), is self-evident. Perhaps, says Mr. Billingsley, in the third volume of the Bath Memoirs, there cannot be a stronger proof of the inferiority of the plough, with respect to profit, than the superior punctuality of the dairy-farmer in the payment of his rent. He never met with the steward of a manor devoted partly to corn and partly to dairy-farms, who controverted this.

Clay.—On this soil, when tenacious and not easily drained, a larger portion should, it is observed, be kept in grass than perhaps on any other; and for this reason,—green winter food is not to be gained at all, or, if gained, not without great difficulty and expense; consequently, the team, and whatever cattle may be kept for consuming straw and making dung, must depend in a larger measure on meadow hay, than upon soils which admit turnip, cabbage, &c. Clover will do on clay, but it is more hazardous and liable to failure; in which case, without a certain resource in the hay of natural grass, the farmer would often find great inconveniences. He has examined many farms with this object in view, and found that, when half the land has been grass, they have been more profitably conducted than with a less proportion; but on no account with less than one-third.

Loam.—It is remarked that one-third or one-fourth in grass is a proportion found suitable to various loams; the more they tend to wetness, the larger the portion. It is not, however, essential on these soils, not only because clover and other artificial grasses are less apt to fail; but likewise by reason of their admitting profitably the alternate husbandry of grass and arable.

Sand.—It is asserted that some rich sands are of so happy a texture, that they do very well in permanent grass, and without burning in slight droughts; but, in general, it may be observed, that sand in its several varieties is, of all other soils, that which pays best in tillage: it is easily worked; expenses are light; it manures itself by agreeing well with sheep; and, as the result of the whole, farmers are usually rich upon it. In respect of the proportion, it is best managed, perhaps, when the whole is under the plough; for, by means of cultivated grasses of proper sorts, all the stock of the farm may be profitably supported, and the land rested sufficiently, for ensuring a perpetual production of corn. But, contrary to this maxim, and most unprofitably, large tracts are commonly tied up from the plough, by covenants of leases, under the name of sheep-walk, heath, &c. which would, by alternate tillage and rest, produce more corn, and keep more sheep, than in the present state: this is particularly the case, he remarks, in Norfolk, Suffolk, Nottinghamshire, &c.

Chalk, including lime-stone soils.—Nearly the same observation is, he says, to be made on this class: they are more productive under the plough than in grass. But landlords tie up their tenants from ploughing downs in Sussex, Hampshire, Dorsetshire, and Wiltshire; but in Gloucestershire, the East Riding of Yorkshire, and Lincolnshire, they have on the whole been less tenacious: still, however, large tracts remain, which would be ploughed were tillage permitted. Rules may be carried too far, and this among the rest. Dorsetshire has its ewe leases, which, in many cases, ought not to be touched; and fine sweet downs, which, by very attentive management have been brought to a considerable degree of fertility, are so useful to sheep in winter, that exceptions must occur. Another motive for ploughing is the peculiar advantages derived on this soil from saintfoin, one of the most useful grasses that we owe to the bounty of Providence, but attainable only by tillage.

Peat, including the immense regions of the moors which spread widely through all the northern counties, and even in the most southern, as Devonshire and Somersetshire, Cambridgeshire and Wales; also the sedgy bottoms are found every where. They admit and call for a much greater improvement than any other soil, comprehending the larger part of the waste lands of the kingdom. These soils are, he thinks, very rarely brought into the state they are capable of, without tillage, and consequently, to prohibit it, is to pass a decree of perpetual sterility. The obstacle, however, most common on moors is, the rights of commonage, which do not come within the scope of the present inquiries. When improved, they are commonly much more adapted to grass than to tillage, not however without numerous exceptions, as we see by the general practice in the fens of Cambridgeshire and Lincolnshire. The alternate husbandry does well upon them: it is easy, however, he says, to be too busy with the plough; for, when good grass is gained, it is the wiser way to continue it in a productive state.

It is further stated, that the subject of the proportion between grass and arable requires a word or two, viewed in another light, besides the relation to soil. This is the prevalent application of the land. In the midland counties, where grazing very widely extends, it is common, he says to see entire farms of grass-land, and the tenant prohibited from breaking up an acre; in such cases there is a motive for

ploughing not immediately connected with soil. To till a part would be right, whatever the soil may be; straw, in such a country, is not to be bought, and the convenience and profit of having some is no inconsiderable object; it would be carefully used as litter, and the manure arising would improve a portion of the land. Some cabbages, or Swedish turnip, or common turnip, might be raised (which, to a certain extent, and for certain objects on such farms, would be highly valuable to the grazier), so as to outweigh large expenses in procuring them on soils not quite adapted to their culture. There is not a question but a farmer in such cases could afford to pay more rent for liberty to plough a portion of his land than under the present covenants. This would, he supposes, extend to a fourth of the farms in soils rather unfavourable to the plough; and to a larger proportion in others. But even three or four small fields, though no more than one-fifth, one-sixth, or one-tenth, would be highly advantageous to himself and the public, and not at all injurious to the landlord or owner.

It is observed in addition, that to dairy-farms, when entirely in grass, as many are in Wiltshire, Gloucestershire, and other counties, this remark is yet more applicable, as the produce of tillage, straw, cabbage, &c. is yet more necessary than in a mere fattening system. In this case, and indeed in most others, the quantity might be partly regulated by the team: a dairy-farmer, who keeps four horses to draw his butter or cheese to fairs, &c. ought, without question, to have tillage enough to employ those horses: and it is no difficult matter to ascertain that quantity. If the various works be examined carefully, it will be found, that a horse to twenty acres of tillage is a fair proportion, which will leave time for carting hay in summer, and the products of the farm in winter. He is not speaking here of tillage farms on sands, &c. or with rotations of crops in which the soil rests for several years; on such the proportion varies; but merely on grass-farms, where some horses must be kept, and are at present unemployed a large part of the year.

It is added that meadow farms, properly so called, are never to his knowledge met with but in the vicinity of great cities, where the demand for hay is great and uniform: horses on such are kept only for the purpose of carrying hay to market, bringing dung back, carting the hay to the stack, and the manure to the fields. Straw is wanting for litter and for thatch; but it is questionable whether it be profitable to plough for this object only in any case; a scattering of tillage is in some places found, but not by any certain rule; the necessity is small, and straw usually to be purchased. Such districts, being highly improved, demand very little attention, he supposes. See *Tillage*, *Rotation of Crops*, and *Pasture*.

Grass-*Lease*, a term applied to such lands as are appropriated to the purposes of grazing, or the feeding of cattle.

Grass-*Seeds*, the seeds of several useful grasses employed in laying lands down to the state of sward. The term was, however, formerly made use of to signify the mixture of seeds scraped up from the hay-lofts, or collected in boxes, below the racks of horses in the stable. In the improved practice of forming new grass-lands, the custom of using such rubbish is properly discarded by the farmer, and only the seeds of such grasses as are really valuable had recourse to, by which much better lands of this sort are provided, than was formerly the case. See *Laying Lands down to Grass.*

Grass-*Sods*, such turfs or sods as are pared off from the surface of lands under the state of old sward, either for the purpose of burning on the ground, fuel, or for being laid down, in order to form a lawn, or small plat of ground, with a fine turf at once. For the former purposes, they have been mostly cut up, or pared off the land, by means of the paring-spade, or plough; but, for the last use, constantly by the spade. An implement of the plough-kind has, however, on the Continent, been found beneficial in cutting turfs for the purpose of being laid down for sward, as will be seen in the following article.

Grass *Sod-Cutter*, an implement of the plough kind, invented by Count Von Maltzen, which has been found useful in cutting grass-sods in a cheap and expeditious manner. It may likewise be made use of with great advantage in paring the swards of old grass-lands, wastes, and commons, previous to their being burnt and brought into a state of tillage.

It may also be applied to the purpose of forming walks in grounds, where they may be wanted, and in paring the bottoms and sides of walks in pleasure-grounds which have been already made, which will leave the gardener only the simple business of raking and rolling them.

And by slight alterations in placing the coulters, grass-sods may be cut in an expeditious manner, and in any form required for the construction of banks, fortifications, huts, &c. It may, of course, be a valuable tool in the expensive business of forming embankments against the sea or other waters.

The Count was led to this invention, from the want of a cheaper mode than the common one of providing grass-sods for turfing with.

In the construction of the tool, the beam or fore part of any common plough will answer, of course this part is not shown in the figure, the operative or hind parts being only given. It is capable of being regulated and managed by any person that can direct a plough. It is represented at *figs.* 7 and 8, in *plate* XLVI. in which the nine holes in the pole or beam A A serve in like manner as the common plough, to set the beam shorter or longer, by placing the pin C forwards or backwards, and thereby to make the iron to work deeper or shallower.

The two coulters EE placed on each side, in front of the cutting-iron D, serve to give the side cut, preparatory to the separation of the sod. The cutting-iron D may, by the means of the screws GG, be raised or lowered at discretion. And in order to keep it in its proper place, the two supports at H

are made and provided for the purpose with several holes at I, made in the cutting-iron D. The two handles are shewn by K K, and the frame by LLLL, all the rest, which in the frame is marked black, means that it is to be made of iron.

It is observed, that some practice is required to use the plough, and, in the commencement, particular care should be taken that the person does not make the sods too deep, that the plough may not be hurt by their inattention. But in a short time they will be in sufficient practice, and the machine will do its work satisfactorily. In the working part, oxen are recommended as preferable to horses, as the former draw more steadily, and are not so unmanageable when the sod is on stiff ground. It must further be observed, that, in beginning the work, a breadth of the width of the two cutters should be previously cut out, by which means the cutting-iron takes the sod at a proper depth, and does the business as soon as the draught commences.

GRATTEN, a term provincially applied to arable lands in a commonable state. But it is used in Cornwall to imply the mowing of grass the first year after the land has been manured with sea-sand; and this operation they call mowing in gratten.

GRAVE, provincially to dig or break up land with a spade.

GRAVEL, a term applied to different sorts of stony materials, which vary in size from that of a pea to a cockle.

GRAVELLING, in *farriery*, a disease in the feet of horses, caused by little gravel-stones insinuating themselves between the hoof and the shoe in travelling, so as to press on the sensible parts, and produce inflammation and suppuration.

According to Mr. J. Lawrence, it takes place chiefly through the nail-holes. And it is, he thinks, one of the many ill consequences of the common method of shoeing; according to which the shoes are hollow, and apt to admit and retain the gravel, the sole being at the same time pared so thin that small stones easily penetrate: hence the horse halts, and endeavours to go upon his toes, and the hoof becomes inflamed; but other accidents, such, for instance, as an ill-shaped clumsy shoe pressing upon the heel, may occasion similar incouvenience.

The method of cure is to take off the shoe, and then open the place with a proper knife down to the quick, picking out all the gravel, so as to admit the matter and coagulated blood to be discharged; afterwards covering the part with lint aud tow, and continuing to dress it in the same way till it is well. The shoe is then to be set on again very carefully; but the horse should not travel or work before he is quite well, or his foot be permitted to come to any wet place.

The same writer also advises not to suffer the sole to be cut away rashly, under the idea of searching for gravel. "But, should there really be gravel, it must needs be drawn out by manual operation, on account of the spiral form of the hoof, which occasions any substance admitted to work upwards towards the coronet; whence a quittor may arise. This shews very clearly the folly of the old practice of stopping up a gravelled foot by night, and suffering the horse to travel on." When the whole of the offending matter is removed, which "will be known by the disappearance of the blackness; wash and deterge well with warm beer, in which is melted some soap."

When the cause is effectually removed, the most lenient applications are probably the best, with poultices applied to the whole foot. And, in extreme cases, the treatment advised under quittor may be proper.

GRAVELLY-*Land*, such ground as abounds with gravel or sand, or which contains a large proportion of gravel in its composition. See *Soil*.

The best kinds of manure for this sort of land are marl, or any stiff clay that will dissolve, or break down with frost, cow-dung, chalk, mud, and composts formed of rotten straw, from the dung-hill.

GRAVELLY-*Soil*, a soil chiefly constituted of that sort of material. See *Soil*.

GRAVES, the refuse of tallow-chandlers' substance, sometimes used as a manure. See *Tallow-chandlers' Graves*.

GRAZIER, a person engaged in the art or business of feeding and fattening different kinds of live-stock on grass-land. In order to be capable of managing this sort of business to the greatest advantage, he should have a perfect knowledge of the nature and value of all sorts of live-stock, as well as of the grounds on which they are to be fed, and of properly suiting them to each other. He should likewise be well acquainted with the nature and state of markets in general. Upon these being well understood and properly attended to, a great deal of his success must depend. By these means proper advantage may be taken of the state of markets. See *Farm*, *Cattle*, and *Live-Stock*.

Mr. Young has well remarked, that the markets for beef and mutton are in common as high about the end of April, as at any other period in the year; as at that time, the supply can only be had from corn or cake-fed beasts, as not one farmer in a thousand has then any winter green food remaining. Of course such beasts as are really fat, are at that season sure to sell well at Smithfield-market. However, with sheep stock, the case is somewhat different; as spring food is now come to those who are well provided, but not in such plenty, on account of the number of bad managers, as to lower the markets to any great extent.

It is of course necessary for the grazier, who has not had much experience, to consider fully the various modes by which he may be able to turn his fat stock into money. The first and chief of which will be Smithfield-market. Where he is situated in a district which is divided into small or middling-sized farms, and where the graziers are mostly in the regular practice of employing district drovers, in whom proper confidence can be placed, he must of necessity be as safe as his neighbours, and may not have reason for any particular caution. This, says he, "is very much the case in East Norfolk. If he occupies a very large farm, of whatever kind, whether an arable grazing one, as in West Norfolk, or a grass-grazing

one, as in Lincolnshire, on a scale that enables him to send many droves pretty regularly to his salesman, he may safely trust to him. The common confidence and integrity of trade then take place. But he is sorry to observe, that he scarcely ever knew a man send accidentally a lot of beasts or sheep to Smithfield, that got as fair a price for them as his great neighbour, who was in constant dealing, got the same day, or his little one, whose stock took the same chance through the means of a confidential drover. The man, who thus drops in a lot, out of the regular course of his business, is rarely satisfied with the treatment he receives. There must be a great deal of truth in this remark, he thinks, because it has been made to him from so many different quarters, and he has suffered in the same way himself."

For this reason, he advises the young grazier to consider this circumstance well, to try the country butchers, and feel his way through the difficulty as well as he can, if his farm be of such a size, and in such a situation, as to lay him open to its influence, and as may render it worth his while.

In this business, the young grazier may derive considerable benefit from the frequent weighing of his animals while alive, as by a comparison of the living with the dead weight, in such cases, as where they are killed in his own neighbourhood, he may soon become able to judge, with a tolerable degree of correctness, of the dead weight of any common sized beast of which he has ascertained the weight while it was alive. And where the living weight has been taken from tables of admeasurement, as those by Banton, he may compare the result with a tolerable accuracy.

The ascertaining the living weight in sheep, calves, hogs, and other similar animals, may be accomplished in the most simple and easy manner, merely by the apparatus of a sort of large cage, having a door at each end, and provided with a pair of large steelyards. The frequent weighing of his fattening stock affords him the means of knowing what advances it makes, what the effects of different sorts of food are, what changes may be necessary in it, and when it may be proper to sell, in case markets should be suitable. In this way, a confidence is gained, that the grazier could not otherwise readily acquire.

Assistance of this nature is not by any means necessary for such graziers as have been long accustomed to the handling and judging of the weights of animals, as they can mostly form pretty correct opinions by the eye and feel, from such long experience, though sometimes they are deceived, the beasts turning out much better and heavier than they expected.

It has been stated, however, by Mr. A. Young, that, "let the grazier be as experienced as he may in buying and selling, and judging by the hand and eye, the butcher will beat him, from having been able to bring the live to the test of the dead weight, in such a variety of cases, that his knowledge is perfect. The grazier, says he, cannot equal him, but his nearest approximation will be by means of carefully weighing."

It is evident, therefore, that it is of much consequence for the stock-farmer at first to make himself as perfectly conversant with this part of the business as possible. See *Grazing*.

GRAZING, the art of pasturing and feeding various kinds of animals on grass-lands with a view of improving their condition, or making them fat. Some districts are more in the practice of grazing than others, as Lincolnshire, Leicestershire, and other midland counties.

This is a system of husbandry that can only be profitably carried on in districts where the extent of pasture is great, or the value of the produce of grass-lands little in comparison with that of animals.

It has been noticed, that there are certain situations, as well as sorts of pasture-land, on which this method of farming may be practised with better profits, and more success, than that of the dairy. This must be the case in all those districts, where the proportion of land in the state of tillage is very small in comparison to that of the pasture kind, consequently the price of produce of the grass sort trifling in comparison to that of fat stock. In all such districts of the kingdom where the grass-lands are of so fine and rich a quality, as to be capable of fattening large bullocks or other cattle, this system may be had recourse to with much success and profit, and is perhaps the best application to which the lands can be applied, as is fully shown by such districts being mostly under some management of this nature.

The art of grazing to advantage depends upon a variety of circumstances, such as those of the nature and quality of the grounds; the propriety of the management of them in respect to feeding, changing, and shutting them up; the properly adapting the stock to them in quantity, size, and quality; the judgment of the grazier not only in selecting such as are most suitable for the purpose and most disposed to fatten, but in obtaining them, where they are to be purchased, at such prices as that they may pay well for keeping; and disposing of them, when fattened, at their full value.

It is well observed by Mr. Kent, that the stocking of land with proper cattle is one of the nicest parts of the science of farming. Where nature is left to herself, says he, she always produces animals suitable to her vegetation, from the smallest sheep on the Welch mountains to the largest sort in the Lincolnshire marshes; from the little hardy bullock in the northern highlands to the noble ox in the richest pastures in Somersetshire. But good husbandry admits of our increasing the value of the one in proportion to that of the other. Land improved enables us to keep a better sort of stock, which shews the double return the earth makes for any judicious attention or labour we bestow upon it. The true wisdom of the occupier is best shown in preserving a due equilibrium between this improvement of his land and stock. They go hand in hand, and if he neglect the one, he cannot avail himself of the other. It should therefore be first considered what kind of cattle or other sorts of stock will answer the purpose best, on the particular description of land upon which they are to be grazed; and next, what sorts

may pay the most in the consumption of the produce.

In general, says he, it will probably be found, that upon strong florid pastures of the driest kinds, the large sorts of cattle, with some of the larger breeds of sheep, will be the most suitable stock: But that where the grass-lands are neither so luxuriant nor so dry, and upon turnip-lands, the small English, Welsh, or Scotch cattle, with some of the small breeds of sheep, will be most profitable. Thus, as different sorts of grass-land and different kinds of produce seem in point of profit to require different descriptions of animals to feed upon and consume their produce, it is of much importance to be at some pains to make the best and most suitable application.

Where the grazier breeds his own stock, he will have little difficulty in selecting such of the different kinds as are the most adapted to his views; but where the animals are to be purchased in, which must most frequently be the case, more care and circumspection will be necessary. It will be proper, though a difficult task, to make a choice of such as have been well kept and are in a thriving condition; as when they have been stinted in their food, and have the contrary appearance, they seldom do so well for the uses of the grazier. It will likewise be of advantage to have them from situations in which the lands are inferior in point of richness. It is observed by Mr. Kent, that many farmers have found great advantage in buying sheep from the poorest spots, as they generally thrive most when they come into a richer pasture; like trees, which endure transplanting the better for coming from a poor nursery. They likewise think that they endure folding and penning better than sheep which are bred on a more luxuriant soil. And they are certainly right, he thinks, in these observations.

It is added, that with respect to the notion which farmers are apt to entertain, that all kinds of sheep will not endure penning, he thinks they labour under an error. He rather believes that all lean or store-sheep are the better for being folded. They are generally more healthy: and, above all other advantages, this one is certainly obtained by it; when such sheep are put to fatten they thrive much better and faster, as oxen do that have been moderately worked.

Where the grazing-lands are very moist, sheep are not by any means a sort of stock to be depended upon, as they are extremely liable to become diseased.

It is likewise necessary, in addition to these points, to have considerable regard to the qualities or properties of the kinds of animals, of whatever sort they may be, in the intention of grazing them with profit; those kind, whether of cattle or sheep, which have the property of keeping themselves fat, or in tolerably full condition, by the least consumption or expenditure of food, being constantly preferred, whatever the size or breed may be, as that is evidently a quality of much greater importance to the grazier than that of mere size, considered in an abstract manner.

Mr. Young well observes, that where there are fine and rich pastures, the grazier may "choose his beasts as large as he can find them, provided they are of the right breed and shape; but let him always prefer shape to size; for it will assuredly pay him better;" and, that "those who are upon indifferent grass must take care to proportion the size of their beasts to the goodness of their pastures: their cattle had much better be too small than too large; as there are vast tracts of land that will answer well in grazing, which are not good enough to support large breeds." And it is not improbable, but that the same thing may hold good in a great degree in regard to sheep.

In such cases, as where the stock is reared upon the land of the farm, which is often a good practice, there can be little difficulty, as has been seen, in fixing upon such animals as are the most proper in these different intentions; but as it must often be necessary for the grazing farmer to purchase his live-stock at fairs and markets, and in other circumstances, much care and attention, as well as knowledge, will be required for him to accomplish it in the most advantageous manner.

It is stated in a system of Practical Agriculture, lately published, to be "of great importance in this business to provide such as have been kept in a proper manner, and are in a healthy, improving state; as, where the contrary is the case, they are difficult, and require a much greater length of time to be brought into the state proper for sale than would otherwise have been necessary. It is, perhaps, experience alone that can qualify the grazier to form a correct judgment in these respects: in general, however, he is led to the choice of stock by no fixed or scientific principles, but by the impression the appearances of the animals have upon him." And, it is added, on the authority of Mr. Marshall, "that the experienced grazier, who has been accustomed to attend fairs and markets, knows at sight, or by the assistance of the slightest touch, whether the animals he is about to purchase will suit him. Their general form and looks please him. They are every where clean; have little offal about them; their eyes are full and vivid; their countenances brisk; their skins alive, and their flesh mellow. On the whole, they have the resemblance of those which have been grazed before with success. Others are rejected, from the grazier not having found any such as they resemble to have done well, but many to have turned out in an unprofitable manner" in his practice.

But the writer of the above work conceives, that there are certain "principles in this branch of the farmer's business which may be attended to with great advantage, as the animals have certain points or parts, the proper or improper forms of which denote them to be valuable, or the contrary for this purpose. These are, that the legs should be short in proportion to the size of the animal; the back

very straight, broad, and flat; the loins wide; the carcase deep round, or rather barrel-shaped below; the fore-quarters round, full, and spreading; the bones small; the flesh affording an elastic feel; the skin thin, and a disposition to fatten well, and on the best parts Where these marks are predominant, the stock is mostly suitable for the purposes of the graziers." And "that where the hair of the hide, in fattening cattle, is inclined to curl instead of being straight, they are most disposed to thrive. This has been found to be the case in practice in different parts of the kingdom," as has been shown in the Annals of Agriculture, and other publications on Husbandry.

"In lean beasts also, he says, when the hair of the hides is curled, they commonly keep themselves in better condition than where the contrary is the case. In all cases a disposition in the animals, of whatever sort they may be, to wildness, and not remaining quietly in the pastures, forms an insurmountable objection in this system of management; as no animal ever fattens well that has a tendency to ramble: it is quietness, feeding quickly, and lying much, that has the greatest tendency to make them become fat in a short time;" a fact which is fully confirmed by what happens in the new Leicester or Dishley breed of sheep, which are so tame and quiet as scarcely to move over a common gutter in the pasture.

And it is added, that "from the result of actual experiment with four different beasts, in which the least possible difference could not be discovered on the most minute examination, it has been shown that too much attention cannot be bestowed in the choice of the breed of fattening stock, as, though they were in every respect the same in appearance, two, from their superior disposition to fatten, were found to afford a profit in the proportion of fifteen shillings the week, while the other two did not yield more than about five shillings and ten-pence." This fact is recorded by Mr. Young, in his Annals of Agriculture, and clearly shows that too much attention cannot be paid by the grazing farmer to the discovery of this propensity in the stocking of his pasture, or other grass-lands.

It must, of course, often happen that the grazier cannot, however, fully avail himself of this, from the impossibility or vast difficulty of procuring such animals, and is consequently under the necessity of buying in such as are more at hand, and ready for his use.

In Leicestershire, and the neighbouring districts, the improved long-horned breed of cattle is mostly had recourse to, from the animals being found to fatten in a ready manner, and to afford good beef. And, in the adjoining county of Lincolnshire, a mixture of the large sorts, of both the long and short-horned breed, are had recourse to as grazing stock, besides those bred in the county, and such as are brought into it by the Scotch drovers.

While, in Somersetshire, the dark red sort or Devonshire breed has been long much in esteem by the graziers, and have lately spread themselves much into the midland districts, as Leicestershire, Oxfordshire, and Warwickshire, from the grazing farmers in these districts finding them to answer upon their pastures more perfectly.

In Sussex, the same breed is also held in considerable estimation by the farmers, as well as their own variety of it, as they are both found to fatten kindly, and with considerable expedition, upon their lands, and to have a ready sale in the market.

But in the more arable or tillage districts of Norfolk and Suffolk, where turnips and artificial grasses are more in use, the Kiloe, Galloway, and other small Scotch breeds, as well as those of the Welch runt kind, are in preferable demand, from their answering better on these sorts of food, their more kindly disposition to fatten, and the excellent quality of their flesh, which never fails to have a ready sale in the London market, where the greatest part of their fat stock is sold.

The grazing farmers in the northern counties have mostly recourse to their own long-horned breed, raised on the farms, with the different Scotch breeds brought into the districts, their home sort being in their experience the least disposed to take on fat.

The large Hereford sort, as well as that kind of Welch cattle termed the Glamorgan, are also very advantageous grazing stock in situations where the pastures are good, and they can be finished with other sorts of food.

Many of the former of these sorts are purchased by the graziers round the metropolis for being fattened or brought considerably forward on the rich grass-lands, which have been mown for hay, and finished with other sorts of food.

The small breeds of the Scotch, Welch, or other similar kinds, may, in many cases of the inferior sorts of grazing lands, often be the most beneficial in affording profit to the farmer, as he can suit them more to the nature and state of such lands, and they have more chance of becoming fat upon them. Indeed it has been stated in the tenth volume of the Bath Papers, on the experience of fifteen years, that the small animal has *generally* "a more natural disposition to fatten, and requires (proportionably to the large animal) less food to make it fat; consequently the greater quantity of meat for consumption can be made per acre." If this point was satisfactorily proved, there could be no doubt of small animals being preferable both on this description of grazing land, and that of a better quality; but, as an able and accurate observer, Mr. Knight, has upon much experience been induced to think differently on this subject, the grazier should be cautious how he has recourse to small breeds upon lands that are capable of fattening large ones, until the question has been fully decided.

In what relates to the sort of cattle that may be employed to the greatest advantage under this system, oxen, and such heifers as have been spayed, are in general considered, by the best informed graziers, as the best sort of stock; as besides being more quiet, the latter have not only the property of fat-

tening in a more expeditious manner, but with a less consumption of food. They are not, however, so readily provided by the grazier. The ox is of course the most commonly, as well as most extensively, employed for the purpose of the grazier, as having the advantage of being capable of being fattened, and of affording good beef, after he has been beneficially wrought in the team of the farmer. Cows, under different circumstances, are likewise often bought in by the grazing farmer for the purpose of being made fat, such as those that have become dry, have slipped the calf at an early period, or are becoming aged; but much caution is necessary in the purchase of this sort of grazing stock, as they frequently turn out less favourably than bullocks or heifers, though in some cases they leave a good profit. When old, they rarely thrive well or get fat with any degree of expedition. Indeed it is, perhaps, the best way, in all cases, for the grazier to have such stock as is not too far advanced in age, as young animals are invariably more disposed to get flesh and become fat, than such as are old. In the grazing of both heifers and cows, they should be suffered to take the bull as soon as they have an inclination, and be ready for being sold off fat several months before the time they would have calved. Such cow or heifer stock as are in calf, may sometimes be purchased in at a cheap rate in the fairs in the autumnal season, and be fattened off in the early spring with a good profit. There is likewise another description of this sort of stock sometimes grazed, which is what are termed *free martins*, or cows that are barren; but they are said to seldom answer in this intention in any high degree.

It may be observed, in relation to the most proper sheep stock for the grazier, that, when the pastures are rich, and afford full keep, the improved large long-woolled breeds, as the new Leicesters, may yield the best profit; but that where the lands are less rich, and the feed of course less plentiful, the small improved short-woolled breeds, as the South Downs, may leave a more ample profit to the farmer. Where wethers of the former kind can be procured, they mostly turn out well for the purpose. And, in the contrary circumstances, perhaps, the South Downs cannot be excelled by any of the short or middle-woolled breeds.

In particular situations and circumstances of grass-lands, many other breeds may, however, be more profitable to the grazing farmer. It is stated, in the Agricultural Survey of Somersetshire, that the Dorsets, formerly so prevalent in that district, have lately given way to the polled native breed of the lower part of the county; from the circumstances of their giving a larger proportion of wool, and their fattening more expeditiously, and at the same time more fully, especially on the internal parts.

On the rich marshes in the southern parts of the island, the grazing farmers, who are mostly in extensive business, have constantly recourse to the polled white-faced breed, and that of the South Down, which they find the most profitable sorts on their lands.

But, in the northern parts of the kingdom, the graziers have principally recourse to the native breeds, the heath and Cheviot sorts, and find the former the quickest in getting fat, and the most hardy in their nature. The Cheviot sort seems, however, lately to have gained ground in the more elevated and hilly situations.

But whatever the breeds of these animals may be that are made use of as grazing stock, it has been found, from long experience, that it is a matter of much importance to procure them from districts, where the quality of the land is inferior to that on which they are to be fattened, as by such means they not only get fat in a more expeditious manner, but without suffering any check upon being first turned upon the lands.

In the grazing of sheep, it is a matter of much consequence that they have a fine close pasture; and that they be prevented from going upon such grass-lands as have been covered by water, and become sandy, as under such circumstances they are liable to become diseased. And, besides this, it may be beneficial in many cases for the farmer to be careful that horses are not turned upon the pastures along with them, as it has been found that the tufts of long rank grass that rise about the dung-heaps, are apt to render them in a state of disease, except where frost has taken place, when the danger is for the most part removed.

It has been supposed, that it is also dangerous to suffer sheep to browse upon the grain, especially that of barley, which shoots up among the stubble, after the harvest is completed: and fallows that are wet and unsound are equally detrimental, whether the soil be *light* or *strong*. In the former situations, they frequently pull up the herbs by the roots, which they eat with the dirt adhering to them, which will inevitably give them the rot; and, if the fallows be strong land, and should not afford a sufficient supply of food, they are liable to the hunger-rot, from being compelled to eat the rank unwholesome vegetables produced on such grounds, especially the lesser spear-wort, and the marsh-penny wort, both of which plants flourish in wet situations, and ought carefully to be eradicated wherever they are found.

And it has been further advised, that in turning sheep into pastures, particularly water-meadows, and also into those places that are subject to rot, to pursue the same precaution as with neat-cattle; which is previously to satisfy the craving of appetite by giving them hay or cut straw, and, after the dew has been evaporated by the rays of the sun, to drive them gently round the field for two or three hours before they are suffered to eat. But, whenever any sort of dry food is given, they ought to be supplied with *pure water*, particularly during the intense heat that usually prevails in the summer months, and which often render the grass as dry as a stubble. "For this purpose, clear light running water is always to be preferred, where it can be obtained; though, in general, whatever water presents itself is made use of. But where this necessary of life is found only in a tainted state, or over-charged with the juice of

dung, it will be advisable to give them well-water, in troughs or shallow tubs. This must be particularly attended to in the folds, so long as the sheep are confined there by the severity of the weather." It has been observed, that "the watering of sheep is, on the Continent, regarded as a circumstance of the greatest moment, and accordingly receives that attention which it requires. Thus, in Sweden, and at the national farm at Rambouillet in France, they are daily watered with running-water, or with that obtained from lakes or springs, *stagnant* water being most (properly and) rigorously prohibited. In some of the Saxon sheep-farms, the sheep are watered in the cots or folds during the winter, instead of taking them to watering-places. Spring or well-water is conducted by means of pipes into troughs, out of which the sheep drink at pleasure; they in consequence drink oftener, and each time take less water, which is favourable to their health. The ordinary mode of watering sheep in that, and we may add in many parts of our own country, is attended with many inconveniences. The animals refuse to drink water in the winter, if it be too cold; they hurry while drinking, and do not take enough when the weather is very windy, or hail, rain, or snow, falls. Besides which, they often disturb the water with their feet: this disgusts them, and at length one part of the flock completely prevents the other from approaching the watering-place." And it has been advised to fold them before the dew falls in summer and winter, and not remove them till it exhales, letting them have hay or other dry food.

It is remarked by the author of the Experienced Farmer, that all grazing-land of rich quality ought to be stocked with sheep, cattle, and horses, so that the grass may be eaten clean off; for, unless it is regularly depastured, much damage ensues. Each of the above three kinds of animals, he says, prefers, as most palatable food, some grasses which the others reject; and none of them will bite near their own dung, though they may near that of others: and thus they conjointly contribute to keep the pasture level without much expense. Pastures or grazing-lands should, he thinks, be kept as level as a bowling-green, both for ornament and use; for, by one part being left higher than another, the long grass keeps increasing in patches; and land where it grows may be considered as taken away from the pasture, as the cattle will almost sooner starve than eat it. By leaving the sort of grasses the animals refuse from year to year, the land, says he, increases in useless plants, and diminishes in useful ones; as the seed of such plants continually drops, and the useful ones are prevented seeding by the cattle eating them. If such pastures were mown in those places, it would, he thinks, give the useful plants room to grow. There are in this kingdom, he adds, an infinite number of acres of rich and excellent land, which, from bad management, and from want of judgment in stocking, become of no more value than a barren soil.

In such grazing-land as is intended for the purpose of feeding cattle, a few sheep are, he conceives, absolutely necessary to eat up the weeds. If any part of the pasture be getting into bents, or higher grass than it ought to be, and the animals begin to neglect it, you must mow it immediately, and as near the ground as possible; for the closer you cut down such coarse parts, the sweeter and the quicker will the grass spring up in the place. Could animals, by hunger, be driven to eat the long grass, they would not fatten upon it; for, as the nearer the bone the sweeter the flesh, so the nearer the ground the sweeter the grass: it is not, he supposes, so much the quantity as the quality of the food that must be attended to.

In further proof of the advantage of hard stocking, it is observed, that it is a common complaint, that the land is good in spring, but it goes off. Is this, says he, to be wondered at, when one-third, or perhaps one-half of the field, is become so rank, that no one animal in the pasture will bite a mouthful of it? Suffer the very best piece of grass-land, entirely free from weeds, to lie without either eating off the grass, or mowing it, and in a few years it will be over-run with weeds, have very little useful grass in it, and in fact be little better than rubbish.

There can be little doubt of the beneficial consequences of hard or close stocking on the older sorts of grazing-land; but on the new leys it should probably be seldom attempted, as injury may be done to such lands without the stock being thereby improved in an adequate degree.

On grazing farms, there are several different systems of management pursued, in respect to cattle, as well as sheep. The practice with some graziers is "to purchase their cattle in the fairs in the autumn-season, about October, or in the following month, supporting them through the winter, principally with straw, or sometimes, which is a much better practice, with a little hay mixed with it, till towards the beginning of March, continuing their fattening through that and the succeeding month with some sort of succulent food, such as turnips, potatoes, or other similar kinds, until the grass be in a state fit to be turned upon in May, on which they may be carried forward and completed, according to circumstances, about August, or in the following month." And another practice "is to purchase the beasts lean, as soon as the grass-lands are in a state fit to be turned upon in May, wholly completing their fattening on the grass about the latter end of October, or later in the autumn, according to their quickness in feeding. In this system of management, the smaller kinds of cattle stock may be found in general the most advantageous, especially where the lands are of the less fertile and luxuriant descriptions."

There is another practice sometimes had recourse to by grazing farmers, but which is, in general, perhaps less profitable than either of the above modes; which is that of buying in stock at such periods, according to the difference in their sizes, as that they may be ready to be sold off about April, or in the succeeding month, a period at which they usually fetch high prices in the markets. It has

been observed, that "in this system, with large oxen or other sorts of beasts, it is sometimes the practice to keep them through two winters, giving them only one summer's grass; being in the first winter not fully fed, but kept in good grass in the summer-season, and forced on with the best feeding in the second; but with the smaller sorts of stock, one summer's grass and a winter's stalling is the usual mode; the cattle being bought in as soon in the spring as the grass is risen to a good bite." It is in very few instances that the animals can pay for this length of keeping. And, it is added, that "in some districts, heifers are preferred to oxen; in which case, they buy them in about March or April, and, after keeping them through the summer, sell in October and November. This method is thought, by some, a profitable system of management."

It has been remarked by the author of the Modern System of Practical Agriculture, on these different systems, that they may all "probably be practised with advantage under different circumstances; but it is obvious that the first can only be had recourse to with propriety, where green winter food is raised in sufficient abundance, and the grazier has a store of litter for being converted into manure. Under other circumstances, the second mode of management will be much more profitable. The two last methods are the least convenient, and, probably, on the whole, except in very favourable circumstances, the least profitable, especially the former of them, as, from the great length of time which they are kept, much management and attention to food becomes necessary to render them advantageous; which, with common servants, is seldom sufficiently regarded."

In addition to these several modes or plans of fattening neat-cattle, there is a practice followed in some rich hay-districts near large towns, and particularly by the hay-farmers in Middlesex, which is, that "of buying in small cattle in tolerable condition in the autumn, as soon as the after-grass is ready, in order to their being fattened out on the rouens, and disposed of towards the latter end of October, or beginning of the following month."

And, in regard to sheep stock, the same difference of system takes place; as, in some cases, where the lands are in a state of inclosure, it is the "practice to buy ewes in lamb in the latter end of summer or beginning of autumn, keeping them on the inferior sorts of grass-lands, stubbles, or fallows, till the beginning of January; and then, by giving them turnips or cabbages, to keep them in good condition through the period of their lambing, and afterwards in the best manner that can be contrived, in order that the lambs may become fit for the butcher sufficiently early to admit of the ewes being afrerwards fattened, and disposed of in the beginning of the autumn." This, in many cases, is found a profitable system of management, but which requires much care and attention.

And another system of practice in this business is, to purchase wether stock about the beginning of May, at the age of two or three years, keeping them sparingly till some weeks after the grounds have been cleared from hay; then bringing them to good keep in the rouen, afterwards fattening them by means of turnips or cabbages, so as not to have them ready sooner than the beginning of March, which is commonly the season in which they fetch the highest prices. In this system of grazing management, a good profit is mostly afforded by farmers, who pursue it in a judicious and steady manner.

And a still further practice in fattening sheep is pursued in some cases with great profit and success, which is that of buying in lambs of the wether, or other kinds, about the beginning of September, which are kept in different methods by different graziers, being by some brought forward with the greatest possible expedition by the best keep, so as to be ready to be sold off as soon as possible. But others have recourse to the contrary method, keeping them only in a middling way during the winter, till about the beginning of April, and then forcing them forward by good keep, so as to have them ready for the butcher in August, or continuing them in the following month; and then clearing the whole of the stock from the land. In this practice, large profits are often made by judicious graziers, especially when situated near large towns.

There is another system of fattening, but which can only be pursued to advantage in situations near large populous towns, which is that of providing grass-lambs for the markets as early as possible in the spring months, which pays the grazier well in many cases. With this view, it is the practice to procure the more forward ewes, such as those of the Dorset breed, which drop their lambs in the beginning of January, if not before. In Middlesex, where this management is much attended to, in consequence of the great demand, it is the custom to purchase this sort of ewes at Kingston, Weyhill, and other fairs in the neighbourhood. The ewes, in order that they may have a plentiful supply of milk, are extremely well kept on turnips, brewers' grains, and fine green sweet rouen hay, and the lambs thereby forced forward in such a rapid manner, as to be ready for the markets in the beginning of March or April. And the ewes, from their becoming dry so early, are capable of being fattened and disposed of towards Michaelmas, usually fetching the prices at which they were purchased in at: as the whole of the stock is in this system cleared within the year, the farmer has the opportunity of fully ascertaining its advantage or disadvantage. The statement is thus given by Mr. Middleton, in his able Survey of the Agriculture of the County of Middlesex:

	£.	s.	d.
Lamb, sold at - -	1	10	0
Ewe, do. do. - -	1	10	0
Wool, 2*s.* 6*d.* or - -	0	2	0
Together	3	2	0
Deduct prime cost	1	12	0
Remains the increase of an ewe in one year	1	10	0

It has been remarked, that "in this management very much depends upon keeping the ewes perfectly well fed, and in dry warm inclosed pastures, as without such attention the ewes are apt to become thin and lean, in consequence of the greatness of the evacuation, and afterwards to require a much longer time in being made fat," by which much loss must be sustained.

In his Midland Counties, Mr. Marshall has suggested a practice in respect to fattening grass-lambs, which in particular cases may be beneficial; which is that of removing the lambs from the ewes when they decline much in milk, before they are perfectly fattened, in order to complete them on young clover, or other sorts of "prime keep." The chief object in this case is, that of the ewes becoming sooner ready for the butcher: Some, also, conceive, that after the first flush of milk is gone, and it begins to be scanty, the lambs thrive better "on grass alone, away from the ewes," than when kept along with them, as the hankering after the little milk that is afforded prevents their feeding freely on the grass. It is here supposed, that "where this method is followed, which can probably be with advantage only where the milk of the ewes is greatly deficient in supporting and bringing the lambs forward, much attention must be paid to having the keep early and in abundance. In this view, rye-grass and white clover for early use, and broad clover at a later period, may be the most proper and useful crops. In this management the ewes should be carefully examined occasionally; and, where much deficiency in the milk is found, the lambs be immediately removed to the pastures."

But in respect to the stocking of grass-lands in the most advantageous manner for the grazier, it must depend materially on the richness of the lands, and the nature of the stock in respect to size, and other circumstances.

According to Mr. Billingsley, the Somersetshire graziers, in stocking the rich and middling sorts of grass-land, allow, to an ox, from one acre to an acre and half; and some add one sheep to each ox. But, in Lincolnshire, they stock in much larger proportions; as is shown in the Agricultural Survey of that district, where they are brought into a tabular form, as below, for the more rich pastures:

Places.	Sheep in summer per acre.	Acres per bullock in summer with the sheep.	Sheep in winter per acre.	Rent.
Long Sutton	5½	2½		
Mr. Scroop	11	No bullocks.		
Boston, &c.	4	1½	2	
Skirbeck	5	1¼	2	
Boston	5	1	3½	
Deeping Fen, Mr. Graves	5	2	1½	40
Alderchurch, Mr. Berridge	7½	2	3	
Swineshead	2½	1	2	
Ewerby	3	2½	2	30
Horbling, &c.	3	2	2	
Howel	3	3	2	
Immingham	1	1½	2	
Grainthorp, &c.	3	3	1½	
Stallenborough	2	2	2	
Skidbrook	1½	1¼	½	
Ditto, &c.	2	2	—	35
Addlethorpe	5	1¼	2	40
Gosberton	6	1	2	
Burgh, &c.	5	2	2	40
Wrangle	2	2	—	36
Hundred of Skirbeck	2	1¼	2½	45
Wibberton	5	2	2	
Marsh Chapel	3	2	—	35
Ditto	3	1	—	45
Grimsby	2¾	1	2¾	
Average	3¾	1¾	2	

On this Mr. Young observes, that "considering the size of the sheep, which cannot be estimated at less than 24 lb. a quarter, on an average; and that the bullocks rise from 50 to 100 stone (14 lb.), this rate of stocking is very great indeed: There are, says he, on every acre 360 lb. of mutton, and reckoning the bullocks at 42 stone, dead weight, there is also 336 lb. of beef; in all, 696 lb. of meat per acre in summer, besides the winter produce, which is immense."

In the rich grazing counties in the more southern parts of the island, a large proportion of both sheep

and cattle stock is admitted per acre: the exact proportion, however, differs with different graziers.

The great and leading principle in this business is, however, never to stock in such a manner as to restrict the animals in the least; as it is by their being enabled to fill themselves quickly, and to lie down much, that the greatest progress and advancement in fattening is made, whether in stock of the cattle, sheep, or any other sort, when at grass. But, on the inferior or weaker grass-lands, a much smaller proportion of stock than on those of the rich and fertile kind only can be employed. It can frequently not be more than an ox and a sheep or two, to two acres, or two acres and a half.

In stocking with neat-cattle, for the purpose of fattening, it should constantly be such as that the animals may have a full bite; but with sheep, such as to keep the pasture in a rather close state of feeding. Another circumstance is necessary to be attended to, in order to bring the grazing stock properly forward in pastures, which is that of changing them more frequently than has generally been the case with grazing farmers. And it is, perhaps, on this principle, as well as those of their affording greater degrees of warmth and shelter, and thereby promoting the growth of the herbage more abundantly, that small inclosures are more advantageous in this practice than large ones. See ***Pasture.***

The practice of different districts, where the grazing system is much in use, will, however, afford a more clear idea of this sort of management.

It is observed by Mr. Young, in the Agricultural Survey of Lincolnshire, that in the low-land in Barton on the Humber, there was a horse-pasture and a sheep one contiguous, and upon the inclosure it was remarkable to observe the great difference between them; that which had been under sheep so greatly superior. And in the tract of marsh-land on the sea-coast they observe, that, where most grass is left in autumn, there the herbage is the coarsest and worst next year. The remark was, it is observed, made in answer to recommending eddish for spring-feeding sheep, which they thought would not do on rich marsh, though it might on uplands. This likewise shows, Mr. Young says, that the Romney Marsh system of close feeding is right, and would answer as well in Lincolnshire. And in the hundred of Skirbeck, they like, it is added, to have a tolerable head of grass in the spring, before turning in; and afterwards so to stock as to prevent its getting coarse by *running away*, so as to prevent the necessity of *hobbing*, which, however, must be done in a wet growing season. Mr. Parkinson observes, that the less sheep are changed the better. This remark, which he takes to be very just, demands, he says, attention: it bears on the question of folding. Beasts are changed while *hobbing* is done; and the sooner it is hobbed the better, as, if cut while young, cattle will eat it.

In Somersetshire, according to Mr. Billingsley, in summer feeding, attentive farmers have the dung which falls from the animal scraped up and wheeled into heaps, and the thistles and rough spots frequently mown.

They also make a point of excluding horses and sheep from their cow-pastures. And when their mown ground is fit to be stocked, they hayn their summer leaze, so as to have a good supply of rough grass or rouen in the winter. They also mow and feed alternately, by which means the best sorts of grasses are preserved and encouraged.

It is also remarked by Mr. Bannister, in his Synopsis of Husbandry, that, "when the summer turns out moist and growing, the herbage often shoots faster than the stock can eat it down. In this case it is common in Kent, to brush over the marshes at the mowing season, though they had not been originally laid in for that purpose; by which economy the farmer becomes possessed of a much larger portion of hay than he had before formed an expectation of, and which, in countries where this commodity fetches a good price, is an advantage whereof he is right to avail himself; for these casual brushings may probably furnish him with a quantity of winter provender sufficient to his own use; whilst those marshes which were primarily intended to be mown, and having been designedly laid in with that view, will produce a commodity of a better quality and more saleable; that may be disposed of at market. On the removal of this old grass, says he, the ground is left at liberty to send forth a more vigorous shoot in the autumn, so that these rouens do at that time produce a sweet and wholesome pasturage, which would otherwise have been choked up with the rotten tore of the last year: yet there are cases where it may be necessary to suffer this old grass to remain on the ground, as where a portion of food is required for the cows or other horned beasts in the winter. Then this old tore, having been sweetened by the frosts, will be found exceedingly useful, and the cattle will at that time greedily devour what in the summer months they turned from with disgust."

It is farther remarked by the same writer, that "the manner of stocking a grazing farm in the marshes differs according to the nature of the land. In Romney Marsh, the views of the grazier are chiefly directed to the breeding and management of sheep: and in the Isle of Sheepey, both bullocks and sheep claim his attention, whilst in some parts the marsh land is wholly appropriated to the breeding of horned cattle and colts. Those grazing farms are, he says, most eligible, which admit of breeding and fattening on the same pasture. This is the case with Romney Marsh, a tract of land so eminently distinguished for a valuable breed of polled sheep, that it furnishes the graziers of Sheepey, and other places in this county, with an annual supply of lean-stock over and above what is reserved for feeding; so that it is evident the grazier here enjoys a double profit from his farm, though, he believes, since the increased value of lean sheep, that the graziers in the Isle of Sheepey have many of them adopted the method of breeding their own stock."

In Westmoreland, the cattle bought in in September are wintered on the coarse pastures and in the straw-yard. In May following the young ones are sent to the commons; and those of an older description turned upon the best pastures as soon as possible, according to the earliness of the situation.

It is stated by the author of the Agricultural Report of the North Riding of Yorkshire, that "there the usual time of breaking the pastures is the 12th May, from which time they continue regularly stocked until about October, when, if the stock consists of milch-cows, or feeding cattle and sheep, they are removed to fog (after-grass): the pastures, with the addition of the stubbles, remain stocked during the winter with store sheep or lean cattle; but the latter are, by many farmers, taken into the straw-yard for the night. The herbage of the pastures is, however, it is thought, thus completely destroyed before winter, and the land thus left naked is starved, and the growth of moss greatly encouraged, to the almost certain ruin of the grass-land. An instance has not occurred, it is added, in the course of the survey, of the practice of preserving a considerable part of the summer growth of grass upon the land, for spring feed, a practice well worthy of attention. This winter clothing, it is supposed, enriches the swath, destroys the moss, and, by keeping the roots of the grass warm, causes an early vegetation in spring, when the scarcity of the herbage so much enhances the value of it. On farms, the soil of which is not adapted to turnips, this practice would, it is said, be peculiar beneficial."

"In March, the land intended to be pastured the ensuing summer, is or ought to be freed, and the stock put into the land intended to be mown, where they remain, until those pastures are broken up in the beginning of May.

"In the dales of the Moorlands, the lower lands only are adapted to meadow; consequently the land cannot be changed alternately from meadow to pasture, as may be practised in many other parts of the Riding; though there, as before noticed, the practice is not sufficiently attended to. There are many instances of cow-pasture, which have been invariably summer-fed during several generations." See *Pasture-Lands*.

"The best farmers usually pasture their new laid ground the first two years, and that chiefly with sheep, as sheep improve grass more than any other kind of stock, both by their treading more lightly and uniformly, and by the dung and urine being more regularly dispersed over the land. But the practice of eating them very bare during the first autumn and winter after sowing, and also mowing them the first summer, is too prevalent: such practices are, it is observed, the ruin of seeds. Some, however, think that pasturing new laid ground is most excellent management; the several grasses, by being frequently cropped, becomes not only firmer in nature, but much more numerous. Stock, when pasturing new lands, ought to be often changed: if ever you over-eat, they will require some time to recover their usual vigour. New laid grounds sometimes give sheep the rot, particularly three or four years laid on indifferent soil.

The practice of shifting the stock from one pasture to another, of mixing different kinds of stock together in a due proportion in the same pasture, and under-stocking with sheep, pastures destined for feeding larger cattle, should always be particularly attended to.

It is stated by Mr. Young, in his Agricultural Survey of Lincolnshire, that "the rich grazing lands are the glory of that county, and demand a singular attention. The soil is a rich loamy clay, some very stiff, but of uncommon fertility, as may be seen by various instances. Some of the grazing lands in Long Sutton that were common, will, he says, carry five or six sheep an acre, and four bullocks to ten acres. Mr. Scrope has there, says he, four acres, which carry forty-five sheep in summer, and must be *hobbed* often to keep it down. And on the grass-lands in Deeping Fen, improved by paring and burning, Mr. Graves keeps five sheep an acre from Lady-day to Michaelmas, and one and a half in winter, and a bullock of 60 stone to two acres besides in summer."

From some trials which were made by T. Fydell, Esq. in the grazing of neat-cattle on the best sort of ground in Lincolnshire, and which are given below, Mr. Young is led to conclude, that *3l.* an acre is the highest rent he has heard of in that county, and much higher than common, even for the best lands. This seems, he says, to confirm the idea he has entertained, that the rich grazing lands of this district are lower rented than such or nearly such lands in other parts of the kingdom.

It is also stated, that "the average weight of the beasts was seventy stone, being of the York or Lincoln breed; the sheep all Lincolns. The former bought in April or May, and all gone by the 11th of December: the sheep are bought in May; they are clipped twice, and sold fat in April or in May following; that there is little difference in seasons, except that after a bad winter, the sheep are not ready for market so soon by a month as they are after good winters. The loss in weight in driving to Smithfield is very little; the expense, beasts *15s. 9d.* sheep *1s. 9½d.* each. Mr. Fydell held for several years a piece of land in Skirbeck parish, which measured twenty-one acres, and kept, *communis annis*, from Lady-day to Michaelmas, nineteen heavy beasts, and a hundred sheep, and wintered fifty sheep. And he now holds a pasture adjoining his garden, at Boston, of eight acres, which keeps in summer ten oxen and forty sheep, and winters thirty sheep. But the finest grazing lands are, he remarks, at Boston, Alderchurch, Fosdyke, Sutherton, Kirton, Frampton, Wibberton, and Skirbeck: these will carry, in summer, a bullock to an acre and a half, besides four sheep an acre; and two sheep an acre in the winter season."

He states that "the Rev. Mr. Berridge, of Alder-

church, has near his house forty acres of the rich grass, upon which the stock is upon an average 300 sheep, sixteen fattening bullocks, three cows, four horses, and carries through the winter three sheep an acre. This land is valued at 40*s*. an acre. It is a vast stock. He favoured him with these particulars in the presence of a dozen neighbours, and called in his manager to confirm it; it wanted therefore, Mr. Young says, no after-corrections."

And, "in the grazing lands at Swineshead, a beast an acre of forty to seventy stone, and two or three sheep; also two sheep an acre in winter. Mr. Tindal, at Ewerby, which is on high-land, compared with Holland Fen, stocks a bullock to two and a half acres, and three sheep per acre in summer, and two sheep an acre in winter. And in the lordships of Horbling, Billingborough, Berthorp, Sempringham, Pointon, Dowsby, Dunsby, and Hackonby, there are extensive tracts of rich grazing land applied to fattening bullocks and sheep, carrying a bullock to two acres, and three sheep per acre in summer; and two sheep an acre in winter, which lands are generally rented at 30*s*. per acre. Mr. Elkington, of Howel, keeps one bullock and nine sheep to three acres, and in the winter two sheep an acre."

But "Hanworth, north of Lincoln, is chiefly grass which is fed by cows, calves, and young cattle. On the Lawn at Norton Place, which is heath-land, two couples per acre in summer; but the soil not adapted to permanent grass without great exertion."

And "there is a tract of pasture-land, which is of considerable extent north and south, but very narrow east and west, which lies in the vale between the heath and the Wolds. He viewed it from Norton Place in going to Owersby, which is in it; the quality is good, but of the second rate."

It is added, that "the grass-land close to Gainsborough lets at 4*l*. and 5*l*. an acre. The marsh grass on the Trent and Knaith, &c. 20*s*. to 30*s*. and produces one and a half or two tons of hay an acre. The marshes on the river are stocked from the 12th of April to the 12th of May: this of late has, however, been omitted, as they found the grass hurt by it. Clear the hay by Lammas, one to one and a half ton an acre. Then turn in milch-cows, and afterwards other stock, till November. Rent 20*s*. but measure short. And at Garthorpe, in marshlands, some rich grazing lands, which will carry a good bullock an acre, but no sheep fed. This land is now let to break up at 3*l*. 15*s*. an acre for fourteen years."

He observes, that "Mr. Hesselden, at Barton, has four acres near the town; levelled and manured it after the allotment, and this year it feeds four cows: three of them joisted at 3*s*. a week, a produce of twelve guineas. At Immingham and Stallenborough, there are some marsh-lands that will carry nine bullocks of eighty stone upon twelve acres, and twelve sheep, and two sheep per acre in winter; some has only one. But the same lordships have, it is remarked, clay pastures that will not do any thing like this. And, at Thornton College, Mr. Uppleby has a few closes of extraordinary fine grazing-land, which will carry the largest bullocks, and it is worth, he thinks, 50*s*. an acre rent.

"The marsh on the coast of Grainthorpe, Saltfleetby, and Theddlethorpe, &c. is very good: it will keep three sheep an acre, and an ox to three acres; and one sheep and a half to an acre in winter. The hilly wold good pastures on marl and chalk at Gayton, near Louth, will carry three ewes and three lambs per acre, and a sprinkling of young cattle, &c. besides; some only two ewes and lambs, besides cattle, such land as is worth 15*s*. to 20*s*. an acre. In the marshes that are in the vicinity of Saltfleet and Sutton, there is some distinction, which it will be proper to note by parishes. In Northcots, the quality rather inferior, being chiefly for breeding. Mars Chapel, better, but still weak; and for breeding also. In Grainthorpe, a great deal very good grazing land. Conisholm, low swampy, and but little good. Skidbrook, a great deal, and very good. South Somercots, the same; but 1000 acres of *ings*, or common meadow. The three Saltfleetby's 5000 acres, and a great deal very strong and good for feeding beasts. Some of the late Mr. Chaplin's marshes here sold so high as 77*l*. the statute acre. In general, the measure short from Saltfleet to Sutton, there statute. In the Theddlethorpes, much very good; but some low, and not well drained. Marblethorpe, very good. Sutton, remarkable good and strong feeding land.

"In these marsh parishes, the rich grazing ground of the first quality lets at about 40*s*. an acre, and the rest about 30*s*. Such as will not feed, but only breed, at 20*s*. to 25*s*.; and this distinction of feeding and breeding is here also expressed by saying, that one sort of marsh will feed sheep; but the other, keep them in holding order, will make them hold the flesh they have got, but not fatten profitably. If the best of these lands are compared with the grazing districts of Boston and its vicinity, it was remarked to him, that these are more naturally good, and much better watered: they have at all times plenty of fresh water here, which is a great object; but for artificial fertility, locality to fairs and markets, &c. the Boston lands are much superior. The measure at Boston, &c. is here said to be more than an acre; here less, not more, than three roods, and the *ing* land still less. On ten acres, at Skidbrook, eight beasts and sixteen sheep have been summered, and the sheep wintered also. And, in general, the marsh that lets from 30*s*. to 40*s*. will carry a beast to two acres, and two sheep an acre; but, perhaps, he says, more generally one and a half sheep.

The profit of grazing the best land is, by Mr. Young, calculated in this way:

	£.	s.	d.
A beast bought at 20*l*. to two acres, at the profits of 5*l*. - - -	2	10	0
Two sheep per acre, bought in at 45*s*. and sold at 55*s*. - - -	1	0	0
Four fleeces at $9\frac{1}{2}$ *lb*. 38 *lb*. at 8*d*. -	1	5	4
	4	15	4

EXPENSES.			£	s.	d.
Rent			2	0	0
Tithe			0	1	0
Rates			0	3	6
Dyke-reeve			0	0	9
			2	5	3
Shepherding			0	1	0
Washing and clipping			0	0	6
Incidents			0	0	6
Capital employed					
Beasts	£20 0 0	£. s. d.			
Sheep	4 10 6	1 6 6			
	24 10 6				
A year's rent	2 0 0				
	26 10 6		3	13	9
At 5*l.* per cent.		Profit	1	1	7

The total interest made is about 9*l.* per cent. on the capital of 26*l.*, and this seems to be rather inadequate, for here is nothing for losses, which in a course of time must be something considerable. The interest made ought to be, at least, 10*l.* per cent. after a proper deduction for losses. Either therefore the land, says he, carries more stock, or it is too highly rented. Grazing is accounted a profitable profession; but when it is considered that this 26*l.* capital would stock five acres of good arable land, and that they could not be reckoned to pay a less profit than from 12*s.* to 15*s.* an acre, from 3*l.* to 4*l.* 5*s.* it will appear that the plough is much more beneficial than such grazing thus calculated.

It is added, that Mr. Kershaw, of Driby, and Mr. Bourne, of Haugh, agree in the following marsh account for land there at 35*s.*

PRODUCE.	£.	s.	d.
Two sheep at 10*s.* the summer	1	0	0
Two ditto in winter	1	0	0
Half the profit on an ox	1	13	4
	3	13	4

EXPENSES.					
Rent			1	15	0
Tithe			0	3	0
Rates and dyke-reeve			0	8	0
Shepherding			0	1	0
Cutting thistles and dressing			0	2	0
Ditches, folds, &c.			0	0	6
Interest of capital					
Bullock half	£6 0 0				
Two sheep	3 0 0	£. s. d.			
Rent	2 0 0	0 11 0			
	11 0 0				
Going to look at stock		£0 0 6			
		3 1 0			
Produce			£3	13	4
Expenses			3	1	0
Profit			0	12	4

Gross interest rather better than 10*l.* per cent.

Mr. Young says, that Mr. Parkinson, of Reevesby, observed, that the rich marshes were better managed, and in better order, twenty years ago, than they are at present; the wold farmers had not then got such possession of them, and they were in the hands of resident graziers, who attend much more to *hobbing*, which kept them fine; for nothing hurts marsh land so much as letting it run coarse, from permitting the grass to get a head.

He calculates an acre of rich marsh in Wrangle, &c. thus,

Rent			£1	16	0
Tithe			0	0	0
Rates			0	6	0
Shepherding			0	1	0
			2	3	0
Dyke-reeve			0	0	8
Ditches, folds, and gates			0	0	6
Interest of capital					
2 Shearlings	£5 0 0				
Bullock to two acres 20*l.*	10 0 0	£0 17 0			
Year's rent	2 0 0				
	17 0 0				
		3 1 2			

PRODUCE.				
Improvement of 2 sheep, 4 fleeces, 3 to a tod, 1[1] tod		1	6	8
Difference in price 10*s.*		1	0	0
		2	6	8
Losses 5*l.* per cent.		0	2	4
		2	4	4
Bullock, profit about 4*l.*	£2 0 0			
Losses one-fortieth	0 1 0	1	19	0
		4	3	4
Expenses		3	1	2
Profit per acre		1	2	2

Or total interest 11*l.* 5*s.* 6*d.* per cent.

And in the hundred of Skirbeck, the pasture consists of three sorts in point of rent, &c. the highest at about 45*s.* being from 32*s.* to 50*s.* The second from 26*s.* to 32*s.* average 28*s.* The third, average 1*l.* 1*s.* Besides this a small quantity of open mea-

dow, called *ings*, average about 18*s*. The best kind of pasture is chiefly stocked with shearling wethers, bought at the spring markets at Boston, which, having yielded two fleeces of wool, are sold off easily in the next year; and by beasts in the summer, sold in autumn; some kept on farther in eddish, but all gone in the winter. The second best is chiefly fed by young beasts and hogs, kept on to shearlings: these are well kept, as their value materially depends on it; there are also some few breeding sheep on this division of the pasture. The third class is chiefly mown. But it is to be noted that all these particulars relate to an acre larger than statute measure, about 4¼ roods."

"The first division is stocked at the rate of three sheep per acre, winter and summer, with the overplus of some bought in the spring, and not cleared from the land till some months later than the time at which they are bought. The beasts are in proportion, on an average of seven to ten acres, from fifty-four to a hundred stone. The second class winters about five sheep to two acres, with not less than four per acre in summer, with a few cows and young beasts; and on both these there will be some few horses, too uncertain to average. On the best land, they are chiefly horses making up for sale; and, on the second quality, horses employed in work, or young ones; it is not usual to keep any horses in summer except on the pastures. The produce of hay on the third may be about 35*s*. an acre; the eddish eaten by cattle from the other grounds; or by lambs or hogs, before they go to their winter keeping."

Grazing Account of ten Acres of the first Quality.

	£.	s.	d.	£.	s.	d.
Rent - -				22	10	0
Tithe, 3*s*. - -				1	10	0
Town charges - -						
Poor and constable, &c. -	0	2	7			
Church -	0	0	3			
Highways -	0	0	5			
In the pound	0	3	3			
				3	12	9
				27	12	9
Dyke-reeve, 5*d*. -				0	4	2
Shepherding, 2*s*. 6*d*. an acre				1	5	0
Fences, 1*s*. - -				0	10	0
				29	11	11
Interest of capital						
Seven oxen, at 14*l*. -	98	0	0			
Thirty sheep, 45*s*. -	67	10	0			
Enters at Lady-day, but a year's charges -	27	0	0			
	192	10	0			

	£.	s.	d.
Brought over	192	10	9
Surplus necessary, because of sheep unsold at time of purchase - -	18	0	0
	210	10	0
Interest at 5*l*. - -	10	10	0
Losses on stock very little indeed, 1*l*. per cent. will probably cover it -	2	2	0
Cutting thistles, hobbing equal to it, stock as above - -	165	10	0
	207	13	11
Incidents - -	5	0	0
	212	13	11
Profit - -	15	16	1
	228	10	0

PRODUCE.

	£.	s.	d.
Seven beasts, at 2*l*. 10*s*. -	121	10	0
Thirty sheep, at 54*s*. -	81	0	0
Sixty fleeces, at 8*s*. -	24	0	0
A horse, twelve weeks -	2	0	0
	228	10	0

Per acre 1*l*. 11*s*. 6*d*. profit
Produce 6*l*. 6*s*. 0*d*. per acre.

It is supposed, that the profit upon this first class of land is greater than upon the rest; and that the third sort yields very little profit by grazing, and would pay much better in tillage. There are many graziers here, Mr. Young says, who have no other land than what is upon these flats, and some who are supposed to have made by their business enough to have realized a comfortable subsistence. The grazing accounts of certain fields in the occupation of Mr. Loft, of Mash Chapel, are thus stated:

	£.	s.	d.
Rent - - - -	£.1	15	0
Tithe - - - -	0	2	0
Rates - - - -	0	3	0
Shepherding - - - -	0	1	0
Interest of capital - - -	0	12	0
	2	13	0

It carries a bullock to two acres, and three sheep per acre.

PRODUCE.

	£.	s.	d.
Half a bullock - - -	£.1	10	0
A sheep and half - - -	1	10	0
	3	0	0
Expenses	2	13	0
Profit	0	7	0

Of better land.

	£.	s.	d.
Rent - - - -	2	5	0
Sundries - - - -	0	7	0
Interest of capital - - -	1	4	0
	3	16	0

It carries a bullock and three sheep an acre.

	£.	s.	d.
A bullock - - - -	3	0	0
Three sheep - - -	3	0	0
	6	0	0
Expenses	3	16	0
Profit	2	4	0

But, he says, it is a very few fields will yield any thing like this: he has but one close; and there are some expenses omitted.

It is likewise stated, that "Mr. Tennison, of Lincoln, has 13 acres of marsh at Grimsby, that summer-feeds fourteen bullocks; and carries thirty-five sheep the year through."

It is added, that "in the tract of marsh-land on the sea coast, they observe, that where most grass is left in autumn, there the herbage is the coarsest and worst next year: the remark was made in answer to recommeding eddish for spring-feeding sheep, which would not do on rich marsh, though it might on uplands." It also shews, that the system of close feeding is proper, and would answer well in many districts where it is not the practice." And "in the hundred of Skirbeck, they like to have a tolerable head of grass in the spring, before turning in; and afterwards so to stock as to prevent its getting coarse by running away, so as to prevent the necessity of hobbing, which, however, must be done in a wet growing season."

After the stock has been brought into a proper state for the market, there is in many situations much difficulty in disposing of it to the best advantage. Mr. Marshall has remarked, that though it be attended with less difficulty than that of buying in the stock, it requires much knowledge, as well as experience, to execute it in the best manner, or with the least possible loss. A due consideration of the progress of the stock while feeding, and of the length of time they have been upon the land, may afford some sort of guide in the business; but the most correct judgment may be formed by the young grazier, by the practice of frequent weighing, and the accurate comparison of the living with the dead weight of such stock as are killed in his neighbourhood, as it is a much more certain method than the use of the eye and hand, as has been shown under the head Grazier. Having recourse to frequent weighing has also the advantage of showing the progress that is made by animals under different sorts of keep or food.

But besides this, the grazing farmer must be regulated in the sale of his stock by the nature of his situation. In most of the midland and southern parts of the kingdom, Smithfield is the place where the fat stock of the farmers are disposed of: but in other parts, they are frequently sold in the neighbourhood, or to the large towns which are at no great distance. In the former cases, especially on the less extensive farms, the fat stock are brought up by persons, who make it a business, being employed by various graziers in the same vicinity, who have an entire confidence in them. With the more extensive graziers, who send up frequent lots, the business is done by a salesman, in whom they have confidence. With little grazing farmers, the custom is often to sell them to the butchers in the neighbourhood, which is frequently the best method.

The advantages of these different modes must depend greatly upon circumstances. Some, however, suppose that the London market is the best calculated only for those who give a weekly attendance, on account of the uncertainty of the supplies. The expenses being materially different, as with the salesman's commission they frequently amount to twelve shillings a head there, while in the country they are not more than from three to five.

It is consequently evident that fat stock may in many cases, where only a few, or what are termed small lots, are to be disposed of, be sold at home with less expense than having them sent to distant markets; but that with large lots, the latter mode must be had recourse to, as more certain and expeditious.

The facts which have been stated fully show that the advantages of the grazing system must be materially different under different circumstances, and be greatly influenced by those of a local kind. It has indeed been remarked by a Kentish grazier, that the profits of no two grazing farmers are exactly "alike on the same given quantity of land," nor even on the same land, as years, prices, as well as the exertions and talents of each individual, are different. In all cases, the superiority of the success must in a great measure depend upon the knowledge, exertion, and excellence of the method which is adopted by the particular farmer. Statements can of course only show what are the general profits of the system.

With neat-cattle, in the western and midland districts, they are thus given by Mr. Billingsley, and Mr. Young, in the Surveys under the direction of the Board of Agriculture.

The former remarks, that a grazing farmer, who has 200 acres of land, may fat annually one hundred head of cattle, as oxen, with seventy sheep and ten colts, which together may afford a comfortable but not exorbitant profit.

Dr.	£.	s.	d.
To rent of 200 acres, average value 40*s.* an acre	400	0	0
To tithe and taxes, say	50	0	0
Feb. To fifty oxen, at 11*l.*	550	0	0
July. To fifty oxen, at 7*l.*	350	0	0
To mowing and making fifty acres of hay, at 10*s.*	25	0	0
To skimming and making fifty acres of summer-leaze, at 3*s.*	7	10	0
To wages throughout the year, besides the farmer's labour	50	0	0
To accidents	20	0	0
	1452	10	0
To profit (interest of capital and accidents included)	277	10	0
	1730	0	0

Cr.	£.	s.	d.
Oct. By fifty oxen, at 18*l.*	900	0	0
May. By fifty oxen, at 13*l.*	650	0	0
By profit on seventy sheep, summer kept	40	0	0
By profit on ten colts	40	0	0
By profit on two hundred sheep winter fatted, and sold in April unshorn	100	0	0
	1730	0	0

But on the rich grazing lands in Lincolnshire, according to the latter writer, the practice seems to afford a much greater advantage to the farmer; as the account, as given by T. Fydell, Esq. M.P. for twenty acres, in 1796, stands thus:

Dr.	£.	s.	d.	£.	s.	d.
To 18 beasts, at 12*l.* each				216	0	0
To 80 sheep, at 46*s.*				184	0	0
To Expenses, viz.				400	0	0
Tithe	1	10	0			
Dyke-reeve	3	0	0			
Rates	10	0	0			
Shepherding	3	0	0			
Expenses	5	0	0			
				22	10	0
Loss, supposed one sheep				2	6	0
				424	16	0
Interest one year				21	4	0
One year's rent				60	0	0
				506	0	0
Hire of a close for the winter, for 35 sheep				17	10	0
				523	10	0
Profit				87	4	0
				610	14	0

Cr.	£.	s.	d.
By 18 beasts, at 19*l.* 5*s.*	346	10	0
By 80 sheep, at 55*s.*	220	0	0
By 52 tod of wool, at 17*s.*	44	4	0
	610	14	0

It is added, that "the difference between the buying and selling price, loss deducted, 208*l.* 8*s.*, is the produce of the land, or 10*l.* 8*s.* per acre, which is very great indeed, and shows that this land would let at 5*l.* 4*s.* an acre, supposing this year to be an average one.

"This difference of rent would deduct 44*l.* from the profit of 87*l.* and leave 43*l.* which, with 21*l.* charged, make 64*l.*; interest on the year's advance of 546, or $11\frac{1}{2}$ per cent."

In the system of grazing pursued in some of the southern rich marshy districts with sheep, as stated some time ago, the amount stands as below, according to Mr. Price; but at present the profit must be much higher, from the improved management of the Romney Marsh graziers.

Account of Stock bought in for Fifty Acres of Pasture Land, for the Year 1778.

	£.	s.	d.
310 barren ewes, at 1*l.* 1*s.* each	325	10	0
90 South Down wethers, at do.	94	10	0
10 steer runts - -	98	15	0
10 Sussex oxen - -	115	0	0
8 steer runts - -	49	10	0
Rent, at 30*s.* per acre - -	75	0	0
Expenses, at 5*s.* per acre -	12	10	0
	770	15	0

Stock sold off Fifty Acres of Pasture Land, in the Year 1788-89.

	£.	s.	d.
310 barren ewes, at 31*s.* each -	480	10	0
90 South Down wethers, at do.	139	10	0
10 steer runts, at 13*l.* each -	130	0	0
10 Sussex oxen, at 15*l.* each	150	0	0
10 ditto, to keep 18 weeks, at 2*s.* per week each - - -	18	0	0
8 steer runts, sold at 9*l.* each -	72	0	0
2 ditto, to keep 12 weeks, at 1*s.* 6*d.* per week each - -	1	16	0
8 packs 3 draughts of long wool, at 8*l.* 10*s.* - - -	74	7	6
1½ ditto of fine wool, at 12*l.* -	18	0	0
Total -	1084	3	6
Deduct -	770	15	0
Clear profit	313	8	6

Profits on Fatting Land, allowing 10*s.* *for each Sheep.*

ONE ACRE.

		£.	s.	d.	£.	s.	d.
Winter,	2 barren ewes, off in May				1	0	0
Summer,	5 wethers, off at Michaelmas				2	10	0
	Wool of 7 sheep, at 12*l.* per pack - -				2	2	0
	One bullock to fat -				3	0	0
					8	12	0
	Rent - -	1	10	0			
	Expenses -	0	5	0			
	Assesses and taxes	0	5	0			
					2	0	0
	Clear profit -				6	12	0

ONE ACRE.

	£.	s.	d.
Three wethers, on at Michaelmas	1	10	0
Two ditto, in May -	1	0	0
Wool - - -	1	10	0
One bullock to fat -	3	0	0
	7	0	0
Brought from bottom	7	0	0
Rent, &c. as before -	2	0	0
Clear profit - -	5	0	0

*Profits on Breeding Land.**

ONE ACRE.

		£.	s.	d.	£.	s.	d.
Winter,	2½ ewes and 3 lambs, at 14*s.*				2	2	0
	Wool of 2½ ewes -				0	13	0
	Wool of 3 lambs -				0	4	6
	Wool of one teg -				0	4	0
The summer improvement of do. -					0	5	0
	Joist bullock keep -				0	10	0
					3	18	6
	Rent - -	1	0	0			
	Expenses - -	0	5	0			
	One in twenty loss by deaths	0	7	0			
					1	12	0
	Clear profit - -				2	6	6

The writer remarks, "on the first of these statements, that the year was favourable for vegetation; and that such profits could not probably be made seven years together, which is the most accurate method of calculating profits on land. There being no assesses on the land, also, makes it more profitable."

And that two modes in respect "to the profits on fattening land are stated; the first used by the best graziers; the other, the most common: some take bullocks in to keep, others buy runts; the profits of which must depend on their judgment; but 3*l.* is the medium profit between the whole: 10*s.* each sheep is generally allowed as the gained profit by fattening." He says, "it cannot be supposed that this profit will always amount to so much, as the years differ; therefore dry seasons will abate it, and a large tract of land cannot have the supply of stock to make it so great. There are losses to be taken out; but, upon the whole, it is very profit-

* Inferior breeding land maintains 2½ sheep on the acre during winter, but good breeding land always three.

able, as the expenses are so moderate, as one servant-man can manage a thousand acres of pasture-land. The value or rent of land is put too low, except for long leases unexpired, or where a large quantity of land is taken. The average price of rent is from 40*s.* to 3*l.* for fattening land, unless four or five hundred acres of breeding and fattening, perhaps about 30*s.*; and some old leases 1*l.* breeding land."

Where sheep, in order to fatten them in a more expeditious manner, or to finish them in cases where the grass is insufficient for the purpose, have the addition of turnips or other sorts of luxuriant green food, great care should be taken, by the grazier, that a due proportion of some sort of dry material be had recourse to at the same time; as without such precaution, not only loss may be sustained by the death of some of the sheep in particular instances, but by their making less progress in becoming fat than would otherwise be the case. Hay, cut chaff, bran, or a few oats, answer the purpose very well. See *Soiling*.

And in order that the consumption of these sorts of food may be conducted in the most economical manner, proper troughs, racks, cribs, or baskets, should be provided, and fixed in such a way, as that they cannot be overturned. The graziers, in some parts of Lincolnshire, have a large sort of crib or wicker-work basket, being eight or ten feet in circumference, and wattled to the height of one foot or a foot and a half, in a close manner, and then left open for about a foot and a half; after which it is closely wattled again for nearly a foot, being drawn in, in a narrowing manner at the top, so as to have only proper room for introducing the food. The studs or staves are placed about eight or ten inches apart, which admits of the sheep feeding in a distinct manner. It is described in the fourth volume of the first series of Repertory of Arts, &c. and denominated a *tumbril*. It is represented at *fig.* 9. in *pl.* L. This contrivance affords much advantage, both in the saving of food from being wasted, and in affording the less strong sheep an opportunity of feeding without being disturbed or driven away by the strong ones.

It has been remarked by Mr. Marshall, in his Rural Economy of the Midland Counties, in respect to the practice of grazing in such seasons as are very wet, that an incident of this sort that occurred to him in the very wet autumn of 1789 is interesting. "The general complaint, says he, is, that grazing stock, though they have this year rolled in grass, have not done well; Mr. Henton, of Hoby in Leicestershire, being singular in saying, that his feeders had done tolerably. Indeed his stock corroborate his assertion. He had a lot of cows at Loughborough, the 12th of August, the fattest in the show.

"But his management is more remarkable than his success." He "foddered them with hay all the wet weather; that is, he mowed the broken grass for them, beginning under the hedges, and continuing to mow the coarsest patches throughout the piece.

"The first day (the day it was mown), the cattle seldom touched it; but the second or third day, they fell to it, freely eating it "between whiles," in preference to grass. In the morning, it was always the first thing they filled their bellies with.

"The cattle having eaten up the more palatable parts of the herbage, the thistles, and other offal, were raked up, and carried off the ground: most excellent management!

"This stock consisted of about sixty head. At first one man only was employed in mowing, &c. But, before the rainy weather ceased, he set on another man.

"What an admirable thought! that which other men suffered to stand waste in itself, an encumbrance to the ground, and a nursery of weeds, was converted to food, more nutritious, in a wet season, than the best of the standing herbage."

A practical observation has also been made by Mr. Parkinson, of Lincolnshire, which is, that "the less sheep are changed, the better." It demands the farmer's attention, as showing the injury of folding in many cases.

It is likewise noticed, that the grazing cattle are changed while the business of *hobbing* the fields is performed, and that the sooner this is executed the better; as when the grass tufts are cut while young, the cattle will eat the produce well.

In regard to the stocking of grazing land, Mr. Marshall remarks that "the fairs at Birmingham are among the worst in the country for fat stock, the butchers giving the graziers no encouragement to drive their stock to them, preferring the toil of riding twenty, thirty, or perhaps forty, miles from home to pick up their "fat!" spending a principal part of their time and their profits in an employment truly ridiculous. How convenient, says he, it would be to the grazier, as well as to the butcher, to have a weekly market, a Smithfield at or near Birmingham! to the grazier, in thereby having a constant and certain market whenever he wanted either keep or money; and, to the butcher, in saving time and travelling expenses. Yet the few animals which are taken there at present, are frequently drove out unsold. But Thursday, which is the ordinary market-day, is, he thinks, improper. Monday or Tuesday would be a more suitable day; and Sutton, perhaps, the most suitable place. In performing the business of purchasing in stock, the nearest fairs are always to be preferred, if it can be done there with propriety; as much injury and loss is frequently sustained by driving from a considerable distance.

The grazing of other sorts of animals may, in some cases, be a profitable concern, but must always be regulated by the nature of the land and circumstances of the farmer. Where he has a considerable extent of the more coarse sort of pasture-land, he may often find it advantageous to graze young horses, especially where he has the convenience of breeding them likewise. But though it is a practice sometimes followed by grazing farmers, to admit horses in the same pastures with the other stock, it should constantly be avoided as much as possible, as they are very injurious by teazing and driving the fattening cattle about, and preventing their resting so much as-

is otherwise the case. It is a better method to let them follow this sort of stock. When horses are admitted upon the grazing lands in Somersetshire, it is seldom done in a larger proportion than that of one to twenty acres.

There is another animal which it has long been a practice in particular situations to graze. This is the hog, which, where the farmer has a piece of rich grass, either of the artificial or natural kind, he may turn upon it with much advantage. With clover, and some other artificial grasses, the animals are found to succeed perfectly well in this sort of management; but it is objectionable as losing a vast source of manure of an excellent kind. When the field is so situated as that the hogs can return in the evenings to the well littered sties, it may, however, be a highly beneficial system of practice. See *Soiling*.

GREASE, in *farriery*, a disease incident to horses or other cattle, consisting of a swelling and inflammation of the legs.

It is sometimes confined to the neighbourhood of the fetlocks; at other times spreading considerably further up the legs, and secreting an oily matter, to which the disease is probably indebted for its name. The discharge has a particular odour, owing, it is imagined, to the secretion of the heels being of a nature peculiar to them. It is said that horses of the heavy class, with round fleshy legs, are the most liable to grease, and the white legs more than the rest. The disease is almost exclusively found in the posterior extremities.

It is brought on by sudden changes from a cold to a hot temperature: such as removing horses from grass into hot stables; from hastily substituting a generous after an impoverishing diet; from the negligence of grooms, in leaving the heels wet and full of sand; and from constitutional debility.

It is observed that, on the first approach of this disease, and for several days previously to any striking appearances of swelling and inflammation, considerable pain seems to be experienced by the animal in the affected heel, as he is continually raising it from the ground, and cannot rest upon it without much uneasiness.

At this early period, the complaint may in general be carried off by a poultice of boiled bran and linseed-powder, constantly applied to the part, and kept moist with warm water; giving every night, or every second night, a mild diuretic, with plentiful exercise on dry and clean ground. But where there already exists considerable inflammation, the poultice, as before directed, may be used, and a diuretic of a rather strong quality, or else a purgative, may be administered, as often as the state of the cure may seem to require.

The disease, according to some, should be treated as a local complaint, where the parts affected are alone concerned, the blood and juices being yet untainted and in good condition; or as a disorder where there is a complication of these; but when it is an attendant on some other distemper, as the farcy, jaundice, dropsy, &c. such diseases must first be cured before the grease can be removed. In the former, moderate exercise, proper dressing, cleanliness, and external stimulant applications, will answer the purpose; in the latter, internal remedies must be called in to our assistance, wth proper evacuations.

Some advise, when the urgent symptoms have abated, and the inflammation seems to have ceased, to wash the heels frequently with the solution given below:

Take of rain or distilled water, one quart; alum, in powder, three ounces; vitriolated zinc, half an ounce: Mix them well together.

Where there may exist any ulceration, it will generally be found to heal by the astringent power of this application; but, if it prove tedious, look foul, and have an offensive smell, pledgets of tow or lint, spread with the following ointment, may be retained on the surface of the sores until they assume a healthy aspect, when they may be discontinued:

Take of ointment of yellow resin, two ounces; verdigrise, in fine powder, half an ounce: Mix them well.

In cases of grease, attended with debility and want of condition in the animal, medicines of the alterative quality should be given.

Take of antimony, in fine powder, flowers of sulphur, of each, six ounces; linseed-powder, two ounces; honey, sufficient to form a mass for twelve balls.

One of which should be given once or twice a-day. The diet should be generous, and the clothing and exercise plentiful.

It has been observed, that obstinate cases of grease may frequently be cured by withholding the horse's allowance of water for two days, or even a longer period; letting him then be ridden into the sea, and his extreme thirst will most probably induce him to drink pretty freely, notwithstanding the unpleasant flavour of that water. In this case, it will be found to act as an useful laxative and alterative. The process must be frequently repeated, wherever it may not appear injurious to the horse in any material point. This simple mode is said to have afforded great benefit to a number of horses belonging to a regiment situated in a maritime quarter, but further trials are required to establish it as a suitable remedy in these cases.

Turning horses into salt-marshes and good grass, after blistering, has also been found beneficial in removing the disease.

As the strength of all applications to the heels must bear a proper proportion to the irritation and inflammation apparently existing, it is necessary to remark, that different remedies, though of a similar tendency, are often required; as any particular formula, when long made use of, is apt to lose its original power. The following formulæ may be employed:

Take of rain or distilled water, one quart; sugar of lead, six drachms; vitriolated zinc, half an ounce: Mix.

Take of rain or distilled water, one quart; vitriolated copper, one ounce: Mix.

Take of rain or distilled water, one quart; vitriolated zinc, one ounce and a half: Mix.

And the following in a dry state may often be more successful:

Take of alum, in fine powder, four ounces; vitriolated zinc, one ounce: Mix.

Take of alum, in fine powder, four ounces; vitriolated zinc, vitriolated copper, of each six drachms: Mix.

Take of alum, three ounces; vitriolated zinc, acetated ceruse, of each six drachms: Rub them together into a fine powder.

These should be applied after the heels have been well washed with soft-soap and warm water, by being slightly rubbed on the diseased parts; but they are seldom or never admissible where the inflammation is great, and they are only to be considered as the means of invigorating and of bracing the skin, with the vessels by which it is supplied.

And others advise, that when the horses' heels are first observed to swell in the stable, and subside or go down on exercise, care should be taken to wash them very clean every time the horse comes in with soap-suds, chamberlye, or vinegar and water, which, with proper rubbing, will frequently prevent or remove the complaint: or to let them be well bathed twice a day with old verjuice, or the following mixture, which will brace up the relaxed vessels; and, if rags dipped in the same are rolled on with a proper bandage for a few days, it is probable the swellings will soon disappear, as the bandage may support the vessels till they have recovered their tone. To answer this end, also a laced stocking, made of strong canvass or coarse cloth, neatly fitted to the part, would be found extremely serviceable, and may be easily contrived:

Take of rectified spirit of wine, four ounces; dissolve in it half an ounce of camphor; to which add wine-vinegar or old verjuice, six ounces; white vitriol, dissolved in a gill of water, one ounce: Mix them together, and shake the phial when used.

But if cracks or scratches are observed, which ooze and run, let the hair be clipped away, as well to prevent a lodgment (which becomes stinking and offensive by its stay), as to give room for washing out dirt or gravel, which, if suffered to remain, greatly aggravate the disorder.

When this is the case, or the heels are full of hard scabs, it is necessary to begin the cure with poultices, made either of boiled turnips and lard, with a handful of linseed powder, or oatmeal and rye-flour, with a little common turpentine and hogs-lard, boiled up with strong-beer grounds, or red-wine-lees. The digestive ointment being applied to the sores for two or three days with either of these poultices over it, will, by softening them, promote a discharge, unload the vessels, and take down the swelling; when they may be dried up with the following:

Take of white vitriol and burnt alum, of each two ounces; ægyptiacum, one ounce; lime-water, a quart or three pints.

Wash the sores with a sponge dipped in this three times a day, and afterwards apply the common white ointment, spread on tow; to an ounce of which may be added, two drachms of sugar of lead.

Or the following wash and ointment may be used for the same purpose:

Take of blue or Roman vitriol, half an ounce; dissolve it in a pint of water; then decant off the clear liquor into a quart-bottle, and add half a pint of camphorated spirits of wine; the same quantity of vinegar, and two ounces of ægyptiacum.

Take of honey, four ounces; white or red-lead, powdered, two ounces; verdigrise, in fine powder, one ounce: Mix them together.

For this purpose some, also, apply alum-curd; others, a strong solution of alum in verjuice, with honey; and many of these forms may be easily contrived. But let it be remembered, as above, that as soon as the swelling is abated, and the moisture lessened, it will be proper to keep the legs and pasterns rolled up with a firm bandage, or linen roller, two or three fingers wide, in order to brace up the relaxed vessels, till they have recovered their natural tone and strength. This method is generally successful when the distemper is only local, and requires no internal medicines; but if the horse be full and gross, his legs greatly gorged, so that the hair stands up, and is what some term pen-feathered, and has a large stinking discharge from deep foul sores, you may expect to meet with great trouble; as this state of the disorder is generally very obstinate to remove, being often occasioned by a poor dropsical state of the blood, or a general bad disposition in the blood and juices.

The cure in this case, if the horse is full and fleshy, must be begun by moderate bleeding, rowels, and repeated purging; after which diuretic medicines, combined with tonics, may frequently be given with success. Thus,

Take of yellow resin, four ounces; of salt-prunella, one ounce: grind them together with a pestle: add a drachm of oil of amber; and give a quart of forge-water every morning fasting, two hours before and after the taking of it; and use moderate exercise.

As this drink is found disagreeable to some horses, it is recommended to have recourse to the bark, with nitre balls in its stead, giving to the quantity of two ounces a day of each for a month or six weeks, mixed up with honey, or in the feeds. The following may also be applied for the purpose:

Take of yellow resin, four ounces; salt of tartar, salt of prunella, of each two ounces; Venice soap, half a pound; oil of juniper, half an ounce: Make them into balls of two ounce weight, and give one every morning. Or,

Take of nitre, two ounces; camphor, one drachm; honey, enough to make into a ball: give it as the former.

The legs, in this case, should be bathed or fomented twice a day with a discutient fomentation, in which, a handful of wood-ashes has been

boiled; applying then the above poultice, or the following, till the swelling has subsided, when the sores may be dressed with the green-ointment, till they are properly digested, and then dried up with the water and ointment above recommended:

Take of honey, one pound; turpentine, six ounces; incorporate them with a spoon; and add of the meal of fenugreek and linseed, each four ounces; boil in three quarts of red wine-lees, to the consistence of a poultice; to which add, when taken from the fire, two ounces of camphor in powder; spread it on thick cloths, and apply it warm to the legs, securing it on with a strong roller.

If the sores are very foul, dress them with two parts of the wound-ointment, and one of ægyptiacum, and apply the following, spread on thick cloths, and rolled on:

Take of black soap, one pound; honey, half a pound; burnt alum, four ounces; verdigrise, powdered, two ounces; wheat-flour, a sufficient quantity.

If the diuretic balls should not succeed, they must be changed for antimonial and mercurial alteratives; but turning a horse out in a field, where he has a hovel or shed to run to at pleasure, would greatly contribute to quicken the cure, and, indeed, would in general effect it alone; but if this cannot be complied with, let him be turned out in the day-time. When a horse is not turned out, a large, and convenient stall is absolutely necessary, with good dressing and care.

The last thing we shall recommend is, to induce the horse to lie down in the stable as often as possible, by giving him fresh clean litter. This is of the utmost consequence, as it will not a little contribute to the removal and cure of the disorder; for, by only changing the position of his legs, a free circulation will be obtained, and the swelling taken down, which is generally aggravated where the horse refuses to lie down; by which means, the stiffness and swelling increases, till the over-gorged and distended vessels are obliged to give way, and, by bursting, discharge the fluids that should circulate through them. It may be proper to remark, that the theory of the disease, as delivered by authors, is greatly to be suspected; at least, if we admit it to bear any resemblance to ædema or dropsy, as suggested above, it behoves the practitioner to be somewhat cautious, lest he *bleed*, rowel, and carry the evacuating system too far. It has been thought, by an ingenious gentleman, who has taken considerable pains in the investigation, that the farcy, the grease, and the glanders, are very nearly allied to each other. How far this idea is well founded, time, and further experience must, however, decide.

The name of this disease is, probably, as has been seen, derived from the nature of the discharge which is thrown out from the skin of the part effected, which is of a greasy unctuous nature.

The part in which the grease always begins, is the fetlock of one of the hind-legs. It scarcely ever is seen in one of the fore-legs; and the reason why it affects the hind-legs exclusively is, probably, their greater distance from the centre of the circulation, the vessels acting more and more weakly, in proportion of their greater distance from the heart. From this circumstance, it should seem to be a disease primarily arising from local debility, and from an inert state of the circulating vessels.

There is something peculiar in the secretions thrown out from the skin of the fetlock, which yields, it is said, in health, a kind of perspirable matter, different from that produced from the skin of other parts. In this, perhaps, there exists the same difference that may be observed between the moisture of the arm-pit, and that of other parts of the skin in the human subject. It has been asserted, that the skin of the fetlock is found, in some instances, to yield matter from its pores, instead of the common sweat, and that without having undergone excoriation, ulceration, or any derangement of texture whatever.

When a horse becomes affected with the grease, several transverse chaps or fissures take place at different distances above the heels. These are greatly aggravated by the motions of the horse, which are continually varying; so that if there existed in these fissures a disposition to unite, it would still be counteracted by the parts being repeatedly put on the stretch, and the union, if any had taken place, would be forcibly torn asunder. During the cure, the horse should therefore, in these cases, be kept as quiet as possible.

It has been recommended, by way of prevention, to have recourse to proper exercise, with attention to cleanliness. The legs of some horses are apt to swell at particular periods, but generally at the approach of winter; to such, diuretics will be serviceable, and will probably prevent the intrusion of grease. Where any debility exists, the habit must be strengthened with nourishing diet, and gentle exercise. It has been suggested, that horses that have never had the hair cut from their heels are scarcely ever found to suffer from the grease. If this be the fact, it may, probably, be owing to the protection which this natural covering forms against the wet, dirt, and cold, and should be well attended to by those who have the management of horses.

Molton Grease. See *Molton Grease.*

GREASY, a term provincially signifying foul.

GREEN, provincially grass-land.

Green *Bug*, a small insect, which frequently destroys plants in fields and gardens. They may be destroyed by sprinkling the places where they lodge, with the juice of henbane, mixed with vinegar. Or the plants, on which they settle, may be watered with the cold decoction of mustard and laurel-seed, mixed with water.

Green *Cheese*, such cheese as is made with some green vegetable juice, such as of sage, &c.

Green *Crops*, are those of the artificial grass, turnip, cabbage, tare, or other similar kinds, which are so denominated in contradistinction to those of the grain sort. The introduction of this sort of crop between those of the grain kind, has formed one of the great-

est improvements in modern husbandry. By means of it, land has not only been prevented from being injuriously exhausted, but brought into a proper state for the growth of corn, without the unprofitable practice of fallowing. It has also had the effect of greatly increasing the number, and improving the quality of live-stock; from their having a more abundant supply of food, and of a better quality. It is obvious, therefore, that these sorts of crops should be grown as much as possible by farmers, in order that a full stock of animals may be kept, and sufficient supplies of good manure be provided.

Much advantage might, in many cases of breeding cattle farms, be obtained by the raising more extensive green crops for the winter support of the stock.

These crops have likewise been found of extensive use in the feeding of milch-cows in winter-dairying, as is fully shown in the useful trials of Mr. Curwen, in a northern district, made with the view of supplying the poor with milk. The value of which in this application, on the supposition of their being sold to the cow-keeper, and the expenses of raising them he thus states:

Twenty-two acres of green crop, at 10*l.* per acre				£.220	0	0

Expenses of raising and cleaning each Green Crop.

Four acres of cabbages, at 12*l.* per acre	£.48	0	0			
Two acres of Swedish turnips, at 5*l.* per acre	10	0	0			
Six acres of common red turnips, at 4*l.* per acre	24	0	0			
One acre of Kahlrabi	5	0	0			
Nine acres of cole, at 3*l.* 10*s.*	31	10	0			
				128	10	0
Gain on crops				£.101	10	0

The improvements in the land, and value of succeeding crops, are supposed to be adequate to the rent and taxes.

This strongly marks the advantage of these crops, even in this use; and should not be lost sight of by the farmer. But, in other applications, they are still more beneficial and important.

They have also been supposed, by some, to be of great utility when turned in as a manure, though others are of a contrary opinion, probably from the conclusions having been taken from trials made on different sorts of soil, and under different circumstances of them. The benefit of this practice will, probably, be the greatest, where such crops are ploughed in during the hot summer months, from their running more quickly into a state of putrefaction, than where autumn is the season chosen for the purpose. Mr. Young advises, that whatever the nature of the crop may be, as rye, tares, or very early sown buck-wheat, it should be ploughed down with the skim-coulter plough, as being the only means of turning them in in so complete a manner as to be wholly concealed. And that, in the case of sowing turnip upon the land, it should have been performed at least three weeks before the seed is put in, which should only be very lightly harrowed afterwards.

Green *Fallow*, such land as is rendered clean by means of green-crops, without having recourse to naked fallowing. It is a great improvement in modern farming. See *Fallowing*.

Green *Food*, such food as is made use of in its green succulent state, in the feeding and support of different sorts of live-stock. This sort of food has lately been much more extensively employed than formerly; but its advantages are not, probably, yet so fully understood by farmers in general, as they ought. A few trials will, however, show their importance and great utility, when properly made.

Green *Sauce*, provincially sorrel.

Green *Scouring*, in *farriery*, a disease to which sheep and bullocks are often subject.

The best remedy, some suppose, for this disease is verjuice; a wine-glass full is enough for a sheep, and a pint for a bullock. See *Scour*.

Green *Side*, provincially grass-land, turf, or sward.

Green *Sod*, provincially grass, turf, or sward.

Green *Sward*, the grassy turf or sward by which land is covered while in the state of pasture, or under the scythe. Such ground as has been long in this condition, is mostly covered with a close compact sward; while, in the contrary case, it is generally light and open. See *Sward*.

GREASY, a term provincially signifying foul or grassy, in relation to fallows or other tillage lands.

GRIFF, a provincial word signifying a narrow valley, with a rocky fissure-like opening at the bottom. A sort of dingle.

GRIP, a small gutter, or ditch, cut across a meadow, pasture, or ploughed field, in order to drain it. In the last, it is mostly called a water, or draining-furrow.

A good method of draining meadow or sward-land, by cutting of grips, is that of cutting out the pieces in a somewhat wedge-like form, and taking off the then bottom part, and then replacing them, by which means, a hollow will be left below, for taking away the water. See *Draining-Furrow*.

Grip, a term provincially made use of to signify the hollow or cavity behind the cattle, in cow-houses or cattle-sheds, into which the dung and urine is discharged. These cavities should always be sunk about eight, ten, or twelve inches below the surfaces on which the cattle stand, in order that the animals may be kept perfectly clean.

GRIPE, a term provincially signifying a dung-fork.

GRIPES, in *farriery*, a very acute disease, to which horses are very often subject. There seems to be no distemper so little understood by the common farrier as the gripes or colic in horses, one general remedy or method of cure serving them in almost all cases; but as this disorder may be produced by very different causes, the cure must also vary, otherwise the intended remedy, injudiciously applied, may not only aggravate the complaint, but make it

fatal. This disorder may be divided into three different kinds: the *flatulent* or *windy*, the *bilious* or *inflammatory*, and the *dry gripes*, each of which are distinguished by their different symptoms, and require different remedies.

The symptoms of the flatulent or windy colic, are known by the rumbling of wind in the bowels. The horse is often lying down, and as suddenly rising again with a spring; he strikes his belly with his hinder feet, stamps with his fore feet, and refuses his meat. When the gripes are violent, he will have convulsive twitches, his eyes be turned up, and his limbs stretched out as if dying; his ears and feet being alternately very hot and cold, he falls into profuse sweats, and then into cold damps; strives often to stale, and turns his head frequently to his flanks; he then falls down, rolls about, and often turns on his back: this last symptom sometimes proceeds from a stoppage of urine that almost always attends this sort of colic, which may often be increased by a load of dung pressing on the bladder. The disorder may originate from the animal having been imprudently allowed to drink cold water in too large a quantity when hot; also from eating too greedily of such sorts of food as are prone to take on fermentation, such as new hay, oats, or clover.

These are the general symptoms of colic or gripes arising from wind, or such causes as the above, and the perspirable matter being retained or thrown on the bowels by catching cold; in all which cases they are violently distended.

In this kind of gripes, the first intention is to empty the straight gut with a small hand dipt in oil, which frequently makes way for the confined wind to discharge itself; and, by easing the neck of the bladder, the suppression of urine is taken off, and the horse stales and gets ease.

The following ball and clyster seldom fail of giving relief in these cases:

Take of Strasburgh or Venice turpentine and juniper-berries, pounded, each half an ounce; salprunella, or saltpetre, an ounce; oil of juniper, one drachm; salt of tartar, two drachms: make into a ball with any syrup: it may be given whole, and washed down with a decoction of juniper-berries, or a horn or two of warm ale.

If the horse does not break wind or stale plentifully, he will find no relief; therefore, in an hour or two, give him another ball, and add to it a drachm of salt of amber, which may be repeated a third time, if found necessary. During the fit, the horse may be walked and trotted gently; but should by no means be harassed beyond his ability, or dragged about till he is jaded.

The following clyster may also be given between the balls, or alone, and repeated occasionally:

Take of chamomile-flowers, two handfuls; of anise, coriander, and fennel-seeds, each an ounce; long pepper, half an ounce: boil them in three quarts of water to two, and add of Daffey's elixir, or gin, half a pint; oil of amber, half an ounce; and oil of chamomile, two ounces.

The subsequent balls and drink are also very proper for this purpose, and to remove gripes occasioned by drinking cold-water when hot, or catching cold after violent exercise:

Take of powder of anise, cumin, and fennel-seeds, of each half an ounce; camphor, two drachms; pellitory of Spain, one drachm; oil of juniper, fifty drops: make them into a ball with any syrup, and wash it down with a horn or two of ale.

It is to be observed, that the horse, in these cases, should be well rubbed, clothed, and littered with clean straw up to his belly. And the following has been found highly useful in flatulent gripes:

Take of Venice turpentine, six drachms, or one ounce; purified opium, from a drachm to a drachm and a half; oil of aniseeds, one drachm; ginger in powder, two drachms.

These substances may be formed into a ball, and the strength of it should be augmented by increasing the proportion of the more active materials, according to circumstances. In the meanwhile, clysters, composed of the decoction of chamomile, or other common herbs, or of the gruel of oatmeal, with half a pint of olive-oil, or an equal quantity of hogs-lard, and half a pound of common salt, should be occasionally injected tolerably warm. In all cases of flatulent colic, there is ever a greater or smaller degree of spasmodic affection, and opium will sometimes remove it, when all other medicines have been made use of without success. An open stable, with plentiful litter, and frequent and gentle motion, are required, if accessible. After the departure of the disease, the food of the horse should be light and sparing, until his health may be supposed perfectly established.

The signs of a horse's recovery are, his lying quiet without starting or tumbling, and his gathering up his legs, and ceasing to lash out; and if he continues an hour in this quiet posture, you may conclude all danger is over.

In the *bilious* or *inflammatory* gripes, besides most of the preceding symptoms, there is fever, great heat, panting, and dryness of the mouth. It mostly arises from costiveness, and an accumulation of indurated fæces. This may be promoted by a want of proper exercise, or too much dry feeding. Many of the symptoms of flatulent colic are here present. The horse also generally throws out a little loose dung, with a hot scalding water, which, when it appears blackish, or of a reddish colour and fetid smell, denotes an approaching mortification. In this case, the horse should immediately be bled to the quantity of three quarts, and it should be repeated, if the symptoms do not abate, in a few hours. The emollient clyster, with two ounces of nitre dissolved in it, should be thrown up twice a day, to cool the inflamed bowels; plenty of gum-arabic water should be taken, and a pint of the following drink given every two or three hours till

several loose stools are procured, and then only night and morning, till the disorder is removed:

Take of senna, three ounces; salt of tartar, half an ounce: infuse in a quart of boiling water an hour or two; then strain off, and add two ounces of lenitive electuary, and four of Glauber's salts.

If this disorder is not removed by these means, but the inflammation and fever increase, attended with a discharge of a black or flesh-coloured water, as above described, the event most probably will be fatal, and the chief thing to depend upon must be a strong decoction of the bark, given to the quantity of a pint or more every three hours, with a gill of red-port wine.

A quart of the same may be used for a clyster, with two ounces of Venice turpentine dissolved in the yolks of two eggs, an ounce of diascordium, and a pint of red-wine, and given twice a day; if the horse recovers, give two or three mild rhubarb purges.

In the last kind, or *dry gripes*, which often arise from costiveness, the horse makes frequent and fruitless motions to dung, which has sometimes a degree of blackness and hardness; he has frequent and quick motion of his tail; his urine is high-coloured, and there is great restlessness and uneasiness. In this case, the straight gut should be examined, and emptied with a small hand, oiled properly for that purpose; the emollient oily clyster, given under the article Glyster, should be thrown up twice a day, and the above purging-drink given, till the bowels are unloaded, and the symptoms removed.

The diet for horses in the gripes should be scalded bran, warm water-gruel, or white water, made by dissolving four ounces of gum arabic in a quart of water, and mixing it with the water.

From this history and division of gripes, and their different treatment, it appears how absolutely necessary it is that they should be well understood, in order to be managed skilfully. It is plain, too, that violent hot medicines should in every species of this disorder be guarded against, and given with great caution and discretion, even in the first kind or flatulent colic, where indeed they can only be wanted; yet too often, when prepared by the farriers with oil of turpentine, geneva, pepper and brine, &c. they even increase that disorder, by stimulating the neck of the bladder, too forcibly heating the blood, and inflaming the bowels, till a mortification is brought on. These are in general the appearances of horses that die of this disorder, whose bowels, being examined for that purpose, have been found inflamed, full of red and livid spots, sometimes quite black, from the quantity of blood with which the vessels were loaded.

GRIPES, a term provincially applied to an implement of the forceps kind, employed for the purpose of eradicating and pulling up weeds of the thistle and similar kinds, when growing among corn, &c. See *Weeding*.

GRIPS, swaths, or small heaps or handfuls of corn lying in the fields after they have been cut down with the scythe or sickle. The term is, however, more generally applied in the latter case.

GROATS, the small grains formed from oats, by being cut in the mill after having the husks or shells taken off.

GROGGINESS, in *farriery*, is a stiffness produced in the foot of a horse by battering the hoof on hard ground. Swelling of the leg and contraction of the sinews often succeed. A horse bearing all upon his heels in his trot is styled groggy, and the defect is generally incurable.

GROOM, a person who looks after, and has the management of, horses; the chief requisites for which are, a mild disposition, and a fondness for the animals which he has the care of. In performing the business of a groom, great attention is necessary to the feeding, dressing, littering, and keeping horses clean. These different operations must be daily executed with the greatest regularity and exactness. The stable, as well as the various articles that belongs to it, should also always be kept clean, and in perfect order. In the feeding of horses, whether with oats, hay, or other kinds of food, it should be a rule never to give them too much at one time, but to let them have suitable quantities at proper intervals. See *Horse* and *Team*.

GROUND, provincially a grass-land inclosure lying out of the way of floods; and a term often used in contradistinction to meadow.

GROUND, a term generally applied to land, whatever the nature of the soil may be. The Romans were very attentive to examine the nature of the ground before they broke it up, and distinguished it into three situations, champaign, hilly, and mountainous. They rightly approved most of a champaign country, declining gradually from the foot of a hill towards the south or south-east of a hill, rising gently; and if a mountain, neither lofty nor rugged, but covered with plenty of wood and grass. Either of these is eligible, according to the purpose for which the ground is intended; some plants affecting hotter, others colder, exposures; some delighting to dwell on hills, others in valleys; and some again being indifferent to either; but, generally speaking, most vegetables choose the warm and kindly soils of low grounds, fertilized by what the rains bring down to them from the hills and more elevated parts.

The spontaneous produce of the earth is, in many cases, an indication of the nature and quality of the ground. Wild thyme shows it to be good for feeding cattle; betony and strawberries direct to wood; chamomile points out a mellow soil fit for wheat; burnet indicates land fit for pasture; and mallows denote it proper for the uses of the kitchen-garden, as has been observed by Lord Bacon, Mr. Evelyn, and others. These are, however, by no means full proofs of the nature of land. On the contrary, says the last mentioned of the above writers, some ground is so cold and poor, as naturally to bring forth nothing but gorse, broom, holly, yew, juniper, ivy, box, &c. which may perhaps direct us to the planting pines, firs, and other perennial ever-greens, in such places. The prevalence of

moss, rushes, wild tansy, sedge, flags, yerrow, and withered, blasted, shrubby, and curled plants, are mostly natural indications of a very bad wet sort of land.

The nature of the ground may also, in particular instances, be pretty well guessed at by the quality of the water, which runs or is strained through it; as where it has a yellow-ochery appearance, or a thick muddy, brownish cast, it may be concluded to be of a tilly or clayey quality; and by the smell, which, upon the falling of the first rain after a long drought, is very pleasing, and even fragrant, from good and natural mould; but disagreeable and noxious if the ground contains any thing of a pernicious quality, as is remarkable in marshes and fenny places. Likewise by the taste, as earths, as well as plants, abound more or less in their peculiar saline matters; some sweet and grateful, others bitter or astringent; and others flat and insipid, which are supposed by some to be easily discoverable by the method, which Columella directs, of digging up some of the under mould out of that part of the land which is deemed the worst, and mixing it thoroughly in an earthen vessel with sweet water, which, when being poured off, after the grosser parts have subsided, may retain the taste of the earth soaked in it. And the touch may immediately show whether it be soft, pliant, unctuous, and slippery; whether it stick to the fingers, or melts and dissolves on the tongue: in the last case it may be deemed rich. If it be gritty, light, and porous, it is not of a good quality. These tests are, however, seldom to be fully depended upon. The only certain methods are those of chemical analysis and practical experience.

The mould, which is supposed the most fit for the production of plants, is that which is of an uniform substance, unmixed with particles of contrary kinds, neither too unctuous nor too lean, but light and easily crumbled, yet of such consistence as to be readily wrought and blended. It is such a tenacity as is sufficient to retain a just degree of moisture, and which neither soils the fingers on being touched, nor cleaves much to the spade, which easily enters it in digging, and which has a sufficient proportion of vegetable or carbonaceous matter in its composition. Of this is the soil usually found under the turf of pasture-grounds, upon which cattle have been long fed and foddered. In short, that is the best mould which is blackest, cuts fine and mellow, sticks not obstinately, breaks readily into small bits, smells sweet, is tempered without crusting or chopping in dry weather, or becoming poachy in wet, which shines after the plough, where flocks of crows follow the ploughman, and, as Pliny expresses it, picks at his heels. As to what respects the colour, next to the blackish, the pre-eminence should generally be given to the darker grey, and after that to the russet; and the clear tawny is reported inferior, the light and dark ash-coloured (light of weight and resembling ashes) good for very little, and the yellowish red the worst of all.

The ancient common opinion, that all grounds are good that are red or brown, and which have a blackish, whitish, or ruddy cast, according as they are cold, moist, or warm, is, notwithstanding the specious arguments alleged in favour of it, from the supposed exhalation of minerals, the heat of the sun, and other accidents, exploded by Columella, who proposes as a much surer way to judge of the goodness of land, by digging a trench, and afterwards throwing back the same earth that was dug out, treading it down well when it is returned. If, says he, through a kind of fermentation, as it were, there be more than enough to fill the trench, it is a certain sign that the soil be fat; if there be not enough, we may be sure that it is poor and lean; and if the quantity be just sufficient to fill the whole of the cavity from whence it was taken, it is of a middling quality. Mr. Evelyn, after examining the component parts of several sorts of soil, concludes that the very finest earths and best moulds, however to appearance mixed with divers imperfect bodies, may, for aught we know, consist more of sandy particles than of any other whatever. Hence he infers, that earth, stript of all heterogeneous particles, retains only weight and an insipid siccity, and doubts whether it affords any thing more than embracement to the first rudiments of plants, protection to the roots, and stability to the stem, being improlific till married to something of a more masculine virtue, which irradiates her womb; but otherwise nourishing only from what is added, without any action or material contribution; for, says he, what gives the divers tempers to moulds, seems rather to be caused by the perpetual and successive rotting of vegetable and animal substances, than by any peculiar and separate principle; the clamminess of the earth seeming rather something extrinsical and accidental to it, than natural, and originally constitutive. We know, continues he, indeed, that the earth is, without any artificial auxiliaries, endued with a wonderful prolific virtue; but as this is liable to be lost or decay, and never can be expected from some grounds without help, it may be worth while to consider by what expedients the desired effects of perpetuating its vigour may best be accomplished. In order to possess the means of giving and perpetuating this vigour, it should be constantly kept in an alkaline or calcareous state. The author just mentioned is clearly of this opinion, and says, that were salt-petre to be obtained in plenty, we should need but little other compost to meliorate our ground. In other words, could the earth be always kept in a state fit for collecting nitre, it would consequently be always in a state fit for the production of plants. They who are acquainted with chemical researches know, that nitre is obtained from substances of a mixed nature. Its basis is a calcareous earth, to which must be added putrid or alkaline substances, especially of the vegetable kind.

So much has been said, by this, and some other writers, of the effects of nitre and nitrous earth in vegetation, that many have imagined it to be essentially necessary in the growth of plants: though Dr. Woodward assures us, that by all the trials he has

been able to make, the very contrary seems to be the case; for that nitre, when contiguous to a plant, rather destroys than nourishes it. When, therefore, they mention nitre and nitrous earths, it is more than probable, that they mean earth in a state fit for collecting nitre; but when the alkaline substances are once saturated by the acid in the air, or when the alkali is brought to a natural salt, as nitre, its fertile state then ceases, and it becomes a hard compact body, much more impervious to the roots of plants than it was before.

The late improvements in chemistry have contributed to elucidate these conjectures and vague opinions, and set the matter in a much clearer, and more perspicuous point of view, as may be seen by referring to various articles in this work. See *Food of Plants*, *Lime*, *Manure*, *Soil*, &c.

The nature of calcareous substances, and that of the two kinds of alkali, namely, the fixed alkaline salt of plants, and the volatile alkali arising from animal and putrid vegetable substances, has been already explained. See *Calcareous Earth*, *Alkaline* and *Saline Substances*, and *Ammonia*.

Farmers commonly say, that lime (to which might be added all other calcareous substances) does not fatten, but only mellows the earth, meaning, according to Dr. Woodward, that it does not contain in itself any thing of the same nature with the vegetable mould, or, in other words, afford any matter fit for the formation of plants; but that it only softens and relaxes the earth; by that means rendering it more capable of entering into, and of nourishing the seeds and vegetables set in it, than would otherwise be the case. It is well known how apt lime is to be put into a ferment and commotion by water: now this commotion can never happen where the lime is mixed with earth (and it retains its qualities of lime), however hard and clodded the ground may be, without opening and loosening it. What Dr. Woodward says of salt in general, may more properly be applied to the fixed alkaline salts of plants. Every one, says he, must have observed how apt all sorts of salts are to be wrought upon by moisture, and how easily they melt and run with it. When this happens to those that are in the earth, the clods which they are mixed with, moulder and fall asunder. The same gentleman further observes, that if we would render the earth truly fruitful, it must be by the addition of such substances as former crops have robbed it of, or such as contains in itself vegetable matter. The several manures which are found best to promote this end are, chiefly, either parts of vegetables or of animals; of animals, says the doctor, which either derive their own nourishment immediately from vegetables, or from other animals that do so, and which, being returned to the earth, serve for the formation of other similar bodies.

These vegetable and animal substances are the matter from whence Mr. Evelyn thinks the earth derives that clamminess, which he takes to be a sure indication of a rich soil. If the effects of the putrefaction of vegetable or animal substances, when mixed with and separated in the earth, be duly attended to, we shall find this a very probable opinion. Vegetables or animals, if exposed to the air, soon putrify and fly off into it; but then they are divided into small portions, and, mixed with the earth, it renders the progress of their putrefaction slower, and entangles the volatile alkaline particles, which would otherwise fly off into the atmoshpere. These are not only strongly attractive of moisture, but, like the fixed alkali, attract the acid in the air, and effervesce with it: whence the double advantage of a moist and loose soil. If we attend to the infinite number of animal and vegetable matters, which are rendered volatile by putrefaction, and fly off into the air, and to the quantity of perspirable matter from animals and vegetables sent into the air, and also to the effects of the acid found every where in the air on such substances, mixed with the earth, we need no longer wonder at the efficacy which writers in all ages have ascribed to the air, with regard to its quality of enriching the earth.

That the peculiar richness of ground is owing, in some measure, to the putrid or rotten particles mixed with it, is an opinion of long standing. This is Virgil's *putre solem*, rotten, crumbling, or loose earth, and that which Columella distinguishes by the appellation of *pinguis et putris*, fat and rotten, or fat, loose, and crumbling; as the soil which yields the greatest profit with the least labour and expense, because it is naturally nearest that state which cultivation is intended to effect; for to cultivate, says he, is nothing more than to open, loosen, and ferment the earth. See *Atmospheric Air*, *Aeration*, *&c.*

On these principles, we may account for the appearances before mentioned of good soils, such as their blackish or dark colour (which is that of all in a putrid state), their ready crumbling, easy mouldering, fragrance of smell, &c. See *Soil.*

Ground *Levelling-Machine*, a contrivance for the purpose of rendering land level and even. See *Machine.*

Ground *Ivy*, a plant of the weed kind, which has the property of striking out roots from the joints of its stalks; but which, as it generally grows under hedges, or upon the sides of banks, cannot be of any great disadvantage to the soil, when in a state of cultivation.

Ground *Officer*, a person who has the overlooking and management of land.

GROWERS, provincially farmers.

GRUB, the name of a large maggot, produced from the *ova* of a certain species of insect. It is of a large size, and does great injury to the corn by undermining it, and preying on its roots. It produces the beetle, and is by some called the rook-worm, because rooks are particularly fond of it. Land newly brought into cultivation, is generally most subject to the grub. The best way of destroying it is by good and frequent ploughings, and the application of lime, in pretty large proportions, in its caustic or most active state, which will generally clear the ground, for some years at least, however infested with this insect.

It is stated, in the Farmer's Magazine, that there are a sort of grubs "met with in wet situations every year, in greater or smaller numbers, in proportion to the heat or cold of the preceding season. While the insect remains in the egg state, no inclemency of weather can hurt it; a fact, of which last year, it is said, affords a convincing proof; for, notwithstanding the severity of the winter 1799, and the coldness and inclemency of the following spring, immense numbers were produced, which, by their ravages upon the oat-crop, contributed not a little to increase the public distress. While in the grub state, it is likewise invulnerable; and the fly produced is equally hardy. The only stage of its existence, in which it appears susceptible of injury, is, it is supposed, in passing from the grub to the aurelia state, when rains and cold weather are fatal to it; and as, in ordinary years, that change takes place about the end of May, or beginning of June, a period at which rain commonly falls in considerable quantity, nearly the whole race perish every year, except such as have taken up their residence in the soft dry molehills that are met with in meadows, or in the sides of ditches; for, upon all the arable lands, it is believed, very few remain to propagate the species, unless in seasons when the weather is uncommonly dry during the whole of the period they remain in the aurelia state, as was the case in 1798. A part of May, and the whole of June, passed over with very little rain; in that way, a great proportion of the eggs, deposited in the arable lands, survived, and became grubs."

It is remarked, that "in tracing the history of an insect so very destructive, and which, were every season alike favourable to its production, would soon render the world a desart, we are struck with the circumstance of its being so readily destroyed by moisture, at the time when the rains, to it so fatal, are so highly necessary and useful to the crops" of grain.

But it is added, that "this grub is not the only one by which the crops are injured. There are several others, pretty numerous, and equally destructive, produced in dry soils, and in all seasons: these, like that already noticed, resist every injury of the weather throughout the year, and in every stage of their existence, except when they are in the aurelia state, when cold and moist weather kills them. The whole of the grubs bred upon dry lands, are of the moth tribe. One of the most destructive of these comes into existence, if the autumn has been very warm, about the end of October, and continues to increase in size, as long as any tolerable degree of vegetation is going on: after which, owing evidently to the want of food, it remains stationary till the following spring; at an early period of which, its depredations are observed. About the end of February, it begins to grow, and continues increasing in size till the beginning of May, when it is upwards of an inch in length, and about one-third of an inch in circumference. It is then exceedingly destructive, and eats through the roots of the strongest stalks of grain in a very short time." The writer "this year took one of them, and put it into the earth, which consisted of soft black loam, at the root of a plant of oats that had sent out thirty-seven offsets, and had been well earthed up. The grub was put in about mid-day, and well covered up. The plant was examined next day, about the same hour; when the leaves were found hanging down, seemingly in a dying state. Upon looking at the root, he found not only the main stem, but the whole of the offsets, so much injured, that there appeared little hopes of their recovery. Accordingly, in a few days thereafter, they were all dead." He further states, that, "in seasons when they are numerous, the mischief they occasion is certainly very great: fortunately, however, nearly the whole race perish every year; and the stock is kept up from the eggs deposited in the sides of ditches, in plantations, and amongst coarse-fogged herbage, which preserve the aurelia from being injured by moisture. In describing an insect so very destructive, it would afford him, he says, great satisfaction to be able to point out a remedy for the evil; of that, however, he confesses himself in a great measure ignorant. Lime, in the act of slacking, is certainly fatal, not only to the grub, but to insects of every description, which come within the reach of its influence. But, though it is thus baneful in a hot active state (a circumstance that well deserves the attention of all farmers), he does not find it equally so, after it has re-absorbed a proportion of carbonic acid, sufficient to reduce it to a powder. It is certain that grubs are less numerous in fields that have been recently limed, than in lands of the same quality, to which no lime has been applied. Still, however, they live in such soils, and propagate their kind; and, he is inclined to think, that after the lime has completely saturated itself with fixed air, and got into a mild state, the vermin will thrive equally well in such fields, as if no lime had been applied. One mode of prevention certainly is in the power of every farmer, namely, that of keeping the tops of ditches, and hedge sides, clean and free from that rough noxious herbage with which they are for the most part covered, and which, along with their serving as a nursery for grubs, and many other kinds of vermin, are a fruitful source of mischief, from the numerous weeds yearly produced upon them, the seeds of which are wafted into the adjoining fields by the winds, and, in spite of fallowing, and every other attention that can be paid, furnish a fresh stock annually, by which the soil is constantly kept in a dirty state, and much labour and expense incurred, that might, with a small degree of attention, be avoided."

But, notwithstanding these judicious remarks, much still remains to be done in order to perfect our knowledge of the nature and modes of destroying these very destructive insects.

Grub-*Felling*, provincially the method of taking down timber-trees, by means of grubbing them up.

GRUBBING, the act of eradicating or clearing lands from the roots and stumps of trees, bushes,

shrubs, &c. Mr. Worlidge observes, that the best and cheapest method of grubbing up thorny shrubs, broom, gorse, &c. is ingeniously delivered by Gabriel Platt, which is that of wrenching them up by means of a strong lever at once. The instrument he has recommended for this purpose, resembles a three-grained dung-fork, but much larger and stronger, according to the bigness of the shrub, &c. the handle resembling a large and strong lever. This instrument being placed about half a foot from the root of the shrubs, &c. and driven a good depth with a strong hedging-beetle, then raised by laying under it a stone or log of wood, is pulled down by means of a rope fastened to the upper end of the handle, and the whole bush wrenched up at once by the roots. See *Clearing of Land.*

Grubbing-*Mattock*, an implement of the pick kind, with two broad cutting ends formed in different directions.

GRUDGINGS, a term provincially applied to pollard or fine bran.

GULPH, a provincial word applied to a mow, or bay-full in a barn.

Gulph-*Stead*, provincially a bay, or division of a barn. It is sometimes pronounced *Goafstead* and *Gostead.*

GUM-*Secretion*, a disease in fruit and other trees, caused by a morbid production of gum. It is very destructive to the trees, and should be removed as soon as possible by the use of drying applications, such as the composition advised by Forsyth, &c.

GUNPOWDER, a material employed by the farmer for the purpose of blasting stones, the roots of trees, &c. It has been found, that the expense of this substance may be greatly lessened by the blending of quick-lime with it. See *Blasting.*

GURRY-*Butt*, a term provincially signifying a dung-sledge. It is a sort of sliding cart, or barrow, used in Devonshire, of such a size as to be drawn by one horse; but sometimes made larger. According to Mr. Marshall, they are useful in drawing compost on fallows; and might, he thinks, be useful on many occasions, as in moving earth, stones, rubbish, manure, &c. to a small distance. The sides and ends are about eighteen inches high, and fixed, the load being discharged by overturning them.

GUTTER, a narrow ditch, or furrow, cut in any kind of ground for the purpose of draining it. It may be very conveniently formed either by the plough, or by means of spades of different breadths following each other.

GUTTERING *of Land*, the forming of drains of this sort, either by the spade or plough, so as to render it dry.

Guttering-*Plough*, a small and simple instrument of the plough kind, and used in some counties for draining wet land. It is small, and worked by a single horse, or a man. A trench four or five inches broad, and six or eight inches deep, may be easily made with it; and, on that account, it is much used in making drains in bleaching and other grounds of that kind, and may do very well for wet clayey meadow-land, where the soil is shallow and apt to produce a large quantity of rushes.

It consits of a piece of iron, about five inches broad, and pointed at the end. Upon this piece, two other pieces are fixed perpendicularly to the former, one on each side, the fore edges inclining backwards; so that the three edges of the instrument form the letter A. To the bottom plate is fixed a socket, for receiving the stale or handle, which is set higher or lower by means of a wedge on the under side. At the end of the stale is a cross piece, three feet long; against which the man's breast is placed when he shoves the instrument before him, in order to cut the drain. A rib, twenty-four inches long, is fixed on the socket, at the end of it; a peg, about a foot long, and two inches diameter, is fastened to the side of the stale with screws. This peg rests on the land, when the clod is turned out of the mouth of the instrument. See *Draining-Plough.*

GUT-*Tie*, in *farriery*, a disease of the bowel kind mostly in calves that have been gelded, and which, by some, is supposed the effect of a bad method of castration, that induces a stoppage in the intestines, the result of which is mortification, and the speedy destruction of the animal. It is said to be common in Herefordshire. The signs of the disease are those of a complete stoppage in the guts, except a discharge of bloody mucus, attended with considerable heat and fever. The animal kicks at its belly, lies down and groans. It may attack the animals when fully grown. In order to remove the obstruction in the bowels, strong saline laxative remedies, with oil, have been had recourse to. And castor-oil would, probably, be useful in this intention; but, in the above district, they have the following operation performed, in order to the removal of the disease: an incision is made in a perpendicular manner, four inches under the third vertebræ of the loins, over the paunch or stomach, introducing the hand to discover the affected part, and remove the string that causes it, the beast being supported during the time in an upright position.

GYPSUM, a substance formed by the combination of calcareous earth with vitriolic or sulphuric acid. It has been found useful as a manure in some countries, as Germany, America, &c. but has not been yet much employed in this kingdom. It constitutes a distinct species of the calcareous genus of fossils; and, according to Kerwan, its general characters are, 1st, *Solubility* in about 500 times its weight of water, in the temperature of 60°. 2d, *Precipitability* therefrom by all mild alkalis; and also by caustic fixed, but not by caustic volatile alkali. 3d, *Ineffervescence* with acids, if the gypsum be pure; but some families of this species, being contaminated with mixed calx, slightly effervesce. 4th, *Insolubility*, or nearly so, in the nitrous acid, in the usual temperature of the atmosphere. 5th, A *specific gravity*, reaching from 2,16 to 2,31. 6th, A degree of *hardness*, such as to admit being scraped by the nail. 7th, When heated nearly to redness, it calcines; and if then it be slightly sprinkled with

water, it again concretes and hardens. 8th, It promotes putrefaction in a high degree.

It is called *fibrous gypsum*; and its colours are grey, yellow, or reddish, or silvery white; or light red, or brownish-yellow, or striped with one or more of these dark colours. It is composed of fibres of striæ, either straight or curved, parallel, or converging to a common centre; sometimes thick, sometimes fine or subtile, adhering to each other, and very brittle: its hardness, such as to admit being scraped with the nail; commonly semi-transparent; in some, often in a high degree.

Its use, as a manure, is said not to have been discovered till about the year 1768, when it was ascertained to be beneficial in this way by Mr. Mayer, a German clergyman. It is, probably, the most advantageous on the drained clayey soils, being spread out or sown evenly over the surface in not too large a proportion, about February, or the following month.

It is also, probably, the best suited to lands in the state of sward, though it has been employed on those of the tillage kind.

In Maryland, in America, it is stated, in the ninth volume of the Agricultural Magazine, that comparative trials with this and other manures were made on rather a stony clay, mixed with a little loam, in order to ascertain the best manure for wheat.

A five acre field (nearly a level surface) was divided into five equal parts, exactly an English acre each. They were equally well ploughed, and laid down in wheat, three English bushels on each acre, after being manured as follows.

On No. 1, was sown six and a half bushels of plaister of Paris, or gypsum, pounded rather fine.

On No. 2, was put a compost manure, which consisted of some lime. The bed of a fresh water river, common dung, &c.

On No. 3, was cowpenned, as is usual in America, by penning the cattle during night.

On No. 4, was put stable-dung, only rather thin.

On No. 5, lime was applied, in the usual way, as in England and Ireland, with oyster-shell lime.

The produce of each acre was as follows:

No. 1, produced full forty bushels. No. 2, thirty-six bushels. No. 3, thirty-five bushels. No. 4, thirty-three bushels. And No. 5, thirty bushels.

N.B. There was a want of rain in the spring, or they would have been greater. The seed-wheat was of the best Sicily grain, weighing 62lb. the Winchester bushel, as imported into Virginia. The produce was a full round grain, weighing 63lb. the Winchester bushel.

The produce of No. 5, with the lime manure, was rather the fullest grain; and, as lime does not answer so well the first year, this acre will probably produce more hereafter.

It appeared that dung, or organic matter, was the first food for wheat, as it is of plants generally; and although it must be repeated every three or four years, will, the writer thinks, turn out in the end the best manure.

The plaister of Paris, gypsum, and lime, will exhaust land much more, and the plaister of Paris more than lime."

In other trials in America, it has been made use of for many years upon old lands, and those in all states of heart, in the quantity of from one to five bushels the acre; but, on high and sandy soils, it was found the most beneficial. Its effects have been great when employed in the proportion of one bushel to the acre annually. It has been found to have good effects on wheat, rye, barley, peas, potatoe, cabbage, clover, and all natural grass-crops. Used in combination with other manures, it is said also to be very beneficial.

In respect to the manner of preparing this substance, when the proper sort is procured, which is such as will not effervesce with *aqua fortis*, nor strike fire with steel; the large lumps should be broken down into smaller ones; and these still further reduced by means of a stumping-mill, when it may be brought into a powdery state by a mill for the purpose; as the finer it is reduced, the more power it has of attracting and retaining the moisture, and of course of proving more efficacious. After being thus reduced, it may be sown over the land by the hand, as other top-dressings.

The following experiments, detailed in the eighth volume of the Bath Papers, were made by a Kentish farmer with this substance upon light loams, and poor calcareous soils, especially of the chalky kind, in the year 1792, 1793, and 1794, and afford the results of repeated trials, showing its effects as a manure for sainfoin, cow-grass, Dutch-clover, &c.

It is first stated, that "all the perches were accurately measured by himself, and the contents, when sufficiently dry, were tied up in bundles, and weighed previous to their being threshed in the field; each parcel of seed was then put in a bag, tallying with the number of the experiment." He next observes, that "each contrasted perch was taken very near the line of partition, that no difference of the soil might affect their products. As the field was above 100 rods long, he ran the experiments in a straight line throughout, at equal distances, which enabled him to compare the natural products with each other, and the relative effects of the gypsum, according as the staple of the soil varied: No. 1 and 2, the soil a very light loamy earth, to the depth of three feet on chalk, which kept gradually rising nearer the surface to the further end, where, at Nos. 7, 8, 9, the surface mould was not more than from two to four inches thick; hence, he thinks, we may naturally account for the product of No. 1, so far exceeding that of No. 8; and it will also shew the immediate as well as permanent effect of gypsum on the two perches 7 and 9, the first gypsumed the 17th of May 1794, the latter in May 1792.

EXPERIMENTS.

No.	Gross weight per perch 61.	Gross weight per acre.			Net weight, seed deducted.			Value thereof at 1s. 6d. per cwt.			Weight per perch.		Measure per acre, at 25lb. per bushel.			Value thereof at 40s. per quarter.			Total gross value of the acreable produce in seed and straw.		
		Cwt.	*qr.*	*lb.*	*Cwt.*	*qr.*	*lb.*	*£.*	*s.*	*d.*	*lb.*	*oz.*	*qr.*	*bus.*	*gal.*	*£.*	*s.*	*d.*	*£.*	*s.*	*d.*
1	23	32	3	12	29	0	23	2	3	9½	2	9	2	0	2½	4	1	6	6	5	3½
2	37	52	3	12	47	2	3	3	11	7½	3	9	2	4	3	5	1	10	8	13	5½
3	31	44	1	4	40	2	24	3	1	0	2	8	2	0	0	4	0	0	7	1	0
4	24½	35	0	0	33	0	9	2	9	7	1	5½	1	0	4½	2	2	9	4	12	4
5	18½	26	1	20	24	0	8	1	16	0	1	8	1	1	4½	2	7	9	4	3	9
6	29	41	1	20	38	0	14	2	17	2	2	5	1	6	6	3	13	9	6	10	11
7	31	44	1	4	42	1	23	3	3	8	1	4½	1	0	1½	2	0	11	5	4	7
8	13	18	2	8	17	3	27	1	7	0	0	6½	0	2	4½	0	12	9	1	19	9
9	27½	39	1	4	37	2	0	2	16	3	1	4	1	0	0	2	0	0	4	16	3

But, in order to ascertain the superior value of the gypsum products over the soot and natural ones, in a distinct and concise view, the writer adopts the following statement of the total money, products, and balances:

	£.	s.	d.
No. 2. Gypsum, six bushels per acre in April 1794 - -	8	13	5½
1. Natural growth - -	6	5	3½
	2	8	2
Deduct the expense of six bushels of gypsum, 2*s.* 9*d.* per bushel -	0	16	6
	1	11	8
No. 6. Gypsum, six bushels per acre in April 1793 - -	6	10	11
5. Natural growth - -	4	3	9
Balance in favour of gypsum, the second year after being sown -	2	7	2

Note. The gypsum expense balanced in the sainfoin crop of 1793.

	£.	s.	d.
No. 3. Gypsum, as before -	7	1	0
Deduct expense of gypsum	0	16	6
Profit by gypsum -	6	4	6
No. 4. Twenty bushels of soot per acre in April 1794 - -	4	12	4
Deduct expense of soot -	0	15	0
	3	17	4

N. B. The gypsum profit exceeds the soot by 2*l.* 7*s.* 2*d.* per acre.

	£.	s.	d.
No. 9. Gypsumed in May 1792 -	4	16	3
8. Natural growth - -	1	19	9
Balance in favour of gypsum the third year after it was sown - -	2	16	6

Note. The gypsum expense of No. 9. balanced in the crop of 1793.

	£.	s.	d.
No. 7. Gypsum, 17th May 1794 -	5	4	7
Deduct expense of gypsum -	0	16	6
Gypsum profit	4	8	1
No. 8. Natural growth - -	1	19	9
Balance in favour of gypsum -	2	8	4

	£.	s.	d.
N. B. The gross amount of the five gypsum numbers together, is -	32	6	2½
The average value per acre -	6	9	3
The gross value of the 3 No's of natural product, including the soot No. 4, is	17	1	1½
The average value per annum £.	4	5	3

He "first entered upon these experiments with a view to his own private satisfaction and amusement: the care and attention he bestowed on them have been amply repaid, on finding the results so uniformly decisive, and exceeding his expectations."

The writer further states, that "having, during the progress of these experiments, remarked several circumstances, which, though not bearing directly on the point in view, seem of too much importance to pass unnoticed, he shall proceed to state such instances as appeared particularly striking and interesting. Upon comparing the seed value of each number, and the proportion it bears to the respective straw product, the difference appears materially to depend on the depth of soil; and all the first six numbers (except the one sown with soot) exceed their straw value by ½ or ⅓, or something above par, whilst No. 7, 8, 9, sink below par, in nearly the same proportions; thus,

		£.	s.	d.
No. 1, gives—Straw, value	-	2	3	9
Seed -	-	4	2	6
	Total	6	6	3

No. 7, —— Straw, value	-	3	3	8
Seed -	-	2	0	11
	Total	5	4	7

The experimenter here asks, if this does not "argue a defect of some peculiar fructifying principle (whatever it may be) in this shallow chalky soil, which even gypsum is not able to impart?—the results at least seem to point out the impropriety of seeding sainfoin on such soils: but, he thinks, it may fairly be presumed that had both the numbers in question been mown for hay, No. 7 would have exceeded as much as it now falls short of the value of No. 1. And here another interesting matter occurs to him, which is, that he purposely reserved half an acre of the poor chalk, out of which No. 7 was taken, to see what effect the gypsum would have had upon it, if sown after vegetation had made some considerable progress: accordingly, on the 17th of May, he had three bushels sown on that part, the sainfoin being then about six inches high, but looking very yellow and unpromising, whilst the greater part of the field, which was gypsumed a month before, had now attained a deep healthy verdure and a vigorous shoot. He must own, he says, there appeared little probability of this late sowing coming to any thing, as the powder hung upon the leaves almost two days, and the weather was apparently set in very dry: a gentle rain, however, falling the second night, washed it all off, and, he supposes, set it to work: for, in five or six days, he could perceive the sainfoin gain colour considerably, and it continued making such a rapid progress as to bid fair, by the middle of June, to outstrip all the rest. On the 10th of July, he had the sainfoin mown, the seed being ripe, except the half acre, which was suffered to stand a week longer, in order to gain a proportion of seed equal to the rest: but he found at last, there was a great deal of light unripe seed, which in some measure accounts for No. 7 falling short of No. 1 in that article more than half. As this last instance undoubtedly gives a most decisive proof of the instantaneous and astonishing effects of gypsum on sainfoin, he shall here close the experiments and remarks on that plant, and proceed to observe, that the lower part of the same field was laid down with cow-grass, sown upon wheat in March 1792; the soil a light loam, to the depth of ten or twelve feet, with a mixture of flints. This part was gypsumed at the times mentioned as above, and the same lines of division for the soot; and intervals, where nothing was sown, ran directly across both parts.

"The cow-grass being mown for hay on the 7th of July, he measured two square perches, taken within a few feet of each other, just before they were carried to the stack, and weighed their contents, which were as follow:

	£.	s.	d.
No. 1. weighed 42lb. per perch, per acre 60cwt. at 2*s*. - -	6	0	0
Charges of six bushels of gypsum, at 2*s*. 9*d*. - - -	0	16	6
	5	3	6
No. 2. Natural growth, per perch 15lb. per acre 21 cwt. 1 qr. 20lb. at 2*s*.	2	2	10
Extra profit by gypsum	3	0	8

"N.B. This proved remarkably fine hay, and is now worth 4*l*. 10*s*. per load.—This profit comes so entirely in unison with those he has stated before, as to require no comment. He shall only state, that the part of the field under sainfoin is worth 6*s*. per acre, and the cow-grass part 10*s*. rent."

He shall now enter upon his "last experiment, which was upon a piece of Dutch-clover, sown the preceding spring upon wheat. Having his doubts whether gypsum would operate with equal effect upon this plant, as upon the tap-rooted tribe, he only sowed about half an acre with it, upon two distinct patches chosen where the soil varied most in quality; one part being a loose mould four or five inches deep on chalk, the other a kindly stiffish loam to a considerable depth, with a slight mixture of pebbles. The whole piece of clover was about five acres, and, upon about three acres of it (the loamy part), there was in general a vigorous but thin plant, of self-sown wheat, which promised in appearance to yield from two to three bushels per acre. This, he thought, added to the clover-seed, would help to make out a tolerable saving crop, considering the extreme dry summer. The sequel will prove, however, how much he was mistaken; for by referring to the subsequent statement of the two perches A. B. both gypsumed alike, and having an equal plant of clover, it appears that by suffering the wheat to ripen on B. there was a deficiency on the clover-seed amounting to 7*l*. per acre (a material object, had the three acres of loam been gypsumed), merely to gain two bushels per acre of wheat, worth 15*s*. which he found the wheat product of the perch amounted to, proportioned to the acre. He has been induced to mention this circumstance, not from its being in any wise the effect of gypsum, but to suggest what useful hints will frequently present themselves in the progress of the most simple experiments, and sometimes indeed of as much importance as the main object in view.

"Previous to a particular statement of the experiments, it may be proper to observe, that the gypsum was sown at the rate of six bushels per

acre, on the 22d of May; the clover at that time, particularly on the chalky soil, looked very pale, and wanted sap; in a fortnight the gypsumed part might be distinguished at a considerable distance; and though we had no rain, yet it soon formed so thick a mat, as effectually defended it from the scorching sun, which nearly burnt up the rest, as may be seen by the scanty products of the two contrasted perches A. and B.: as under is the statement of the experiments alluded to."

Straw Product of Dutch-Clover.

	Per perch.		Per acre.			Net product.			Value at 1s. 6d. per cwt		
	lb.	oz.	cwt.	qr.	lb.	cwt.	qr.	lb.	£.	s.	d.
A. Gypsum'd	15	8	22	0	16	19	1	14	1	9	0¼
a. none	5	8	7	3	4	7	1	5	0	10	11
B. Gypsum'd	15	0	21	1	20	19	3	18	1	9	10
b. none	9	0	12	13	12	12	1	8	0	18	6

Seed Product.

	Seed per perch.		Seed per acre.			Value at 12d per lb.			Gross amount.		
	lb.	oz.	cwt.	qr.	lb.	£.	s.	d.	£.	s.	d
A. Gypsum'd	1	15	2	3	2	15	10	0	16	19	0¾
a. none	0	5½	0	1	27	2	5	10	2	16	9
B. Gypsum'd	1	1	1	2	2	8	10	0	9	19	10
b. none	0	6	0	2	4	2	10	0	3	8	6

He thinks that "the results of the gypsum perches sufficiently prove that it operates as forcibly on this plant as upon sainfoin, with respect to gross product; but the value of Dutch clover-seed being so superior to that of sainfoin, has occasioned the money value of the seed product A. to exceed the highest sainfoin-seed product No. 2, as 3 to 1; and, upon deducting the gross natural product *a* from the gypsum product A, it will appear that there is an absolute gain of 14*l.* 2*s.* 3*d.* per acre, at the expense only of 16*s.* 6*d.* for six bushels of gypsum.

"The invariable results of the several experiments, which are faithfully, and, he trusts, correctly stated, do, he thinks, incontestibly prove that there is a most powerful and subtile principle in this tasteless stone; but by what peculiar agency or combination it is capable of forcing vegetation in such an instantaneous and astonishing manner, is a mystery which time reserves for others to unfold. But until this period arrive, the practical and most cautious farmer will, he hopes, run no great hazard in venturing some small trials on the credit of the above matters of fact, which he has faithfully and truly stated."

The trials of Sir R. Sutton, as detailed in the Annals of Agriculture, are not, however, by any means so favourable.

In the course of the month of February he dressed, in his home farm, six acres of ground with pounded plaster, six hundred weight to the acre; two of these acres were young red-clover, two white-clover and grass-seeds, and two natural meadow.—The soil where the red-clover was, a good hazel mould, with a strong loam underneath; the others a strong loam, more inclined to clay.—At the same time he dressed eleven acres of young grass-seeds on his forest farm, the soil sand and gravel, and ten acres more of oats and barley, as soon as they came up; all at the same rate of six hundred weight per acre. He allowed double the quantity recommended by Mr. Schubart, on account of his plaster running in a narrow vein, being seldom above an inch and a half thick, which was transparent and sparkling; but could not be got without a good deal of a dead white stone, and sometimes of a reddish stone clinging to it; the strips were all chose in the middle of fields, and accurately staked out.—Upon inspection, at several different times during the growth of the crops, and at harvest, no advantage could be perceived over the adjoining crops; his farmer, indeed, thought some had suffered by it; but in this he might be prejudiced. He calculated the expense of getting, carrying, grinding, and spreading the eight tons laid on twenty-seven acres, at 6*l.* 9*s.*

In another trial, where it was laid on the proportion of 250 cwt. nearly on seven acres of his land, which is a strong red loam, and thirteen acres of forest farm, sand and gravel; it was laid on strips amongst the land, not dressed, and all on clover and grass-seeds; and, upon inspection, by several persons, not the least difference was perceived, either during any time of the growth, or at mowing; the plaster was brought from Newark, of the best kind: he thinks he must infer from this, that the common plaster is of a very different quality. The expense was as follows:

On seven acres at Norwood.

	£.	s.	d.
One-third of the carriage - -	0	4	0
One ditto of grinding - -	0	16	8
Carrying out and sowing - -	0	5	0
One-third of 50 cwt of plaster -	0	4	2
	1	9	10

Or 4*s.* 3*d.* an acre, with a fraction: 5*s.* more should be added for carriage, five and a half miles, and to farm-field, or a little above, 4*d.* an acre.

And in a further trial made with French gypsum, the result nearly the same. On the 29th of April last, one bushel was sown upon a rood of land, measured and staked out in the middle of a three-acred piece of red-clover, at his home farm, the soil a good loam; and the other, the same day, on the like quantity of land, likewise measured

and staked out in the middle of a piece of fifteen acres of white clover and grass-seed, in his forest farm, the soil a poor sand. During the whole day following, there fell a gentle soaking rain. However, being viewed at many different times during the growth, whilst in swath, and in after-grass, there was not the least perceivable advantage over the other lands, which had no dressing.

But in Norfolk, according to the Survey of that district, lately published, "Mr. Allen tried this manure, very carefully, at Stanhow, on clean clover.

March 31. No. 1 and 4. No manure; produce average of the two, 38lb. 6oz.

2. Four quarts sifted coal-ashes kept dry, 50lb.

3. Gypsum, one quart, 54½lb.

The ashes, therefore, gave an increase of 11lb. 10oz. and the gypsum of 16lb. 2oz."

More correct trials, made with greater attention to particular circumstances, would seem to be necessary to ascertain in what sort and situation of land this substance may be employed with the most beneficial effects.

In America, Mr. Parkinson found this substance to be only useful where the land was of the drier kind, and made rich by dung; indeed, not "to have been of any utility, except in clover." From the smallness of the quantity employed, he seems to think it improbable, that it contains any thing of the food of plants. He considers the principal use of it, to be that of attracting moisture from the atmosphere, and thereby hindering the heat of the sun from affecting the soil to so great a depth, and the preventing exhalation, as was evident from the darker appearance of the ground. It was in these ways, and that of defending the young plants from the scorching heat of the sun, that it became so beneficial to turnips in his trials. "It covers the soil," he says, "and keeps the ground moist and cool all the summer."

It had a surprising effect on four rows of turnips in his first trial, which induced him to get a bushel more, and sow it upon another square near a road, when, in twenty-four hours, he could discern the crop to be of a much deeper green; and, in forty-eight, so much so, as to have induced a belief of the soil being there of a superior quality. He afterwards sowed another bushel of it on two rows, and missed two rows; the turnips grew to a much greater size where the gypsum was sown, than in the rest of the field, as in the proportion of about two to one in weight, where the two first bushels were applied, and about three to two where the last bushel was laid on; besides being much juicier and better in their kind.

On the whole, he is not of opinion, that gypsum would answer so often, or so well, here as in America; but he doubts not of its being of great service, and especially on turnips, in hot dry seasons.

He says, two bushels will suffice for an acre in drills. French and Nova Scotia gypsum were used, being first ground fine. In this country, from six to eight bushels have been employed per acre.

H.

HACK, a pick-axe, or mattock, that has only one end, and that a broad one. A sort of half mattock, which is a very useful tool.

Hack, in *horsemanship*, a general term for a road-horse, which is said, by some, does not by any means convey any sense of inferiority, or refer exclusively to horses let out for hire. It is, however, often used in that signification.

HACKLE, provincially a small hack. It is also a term applied to the raising of turnips, &c. by a little two-pronged hack. It also signifies an implement used in dressing flax.

HACKLES, a term provincially applied to the cones or singlets of beans, tied and set up to prevent them from wet.

HACKNEY, a horse used chiefly for riding upon. It is observed by Mr. R. Lawrence, that those who possess "a thorough-bred hack or hunter, sufficiently short-legged, lively, and active, which bends its knees, and goes well above the ground, and has sound tough feet, has perhaps obtained every qualification they can wish for the road, except trotting; which they must never expect, in any extraordinary degree, in a bred horse. But horses of such a description are not, he says, common, because unfit for the turf; and nobody, as yet, has bred racers expressly for other purposes. The disadvantage of bred cattle for the road or field, are, he thinks, too great delicacy, rendering them susceptible of harm from wet and cold; tenderness of legs and feet; too great length of leg and thigh, and pliability of sinew, which gives a more extensive compass to their strokes than is convenient to the common business of riding, or even of hunting; their stride also, natural sluggishness, and tender feet, occasion them to be unsafe goers." He consequently asks, "which then is the most proper species for the road? or rather, since it is agreed that blood is absolutely necessary, how much ought a hackney to have? He believes, he ought either to be three parts bred, as one got by a racer out of a half-bred mare, or *vice versa;* or one which is produced from good-shaped hackney-stock on both sides, both sire and dam having some blood. He inclines to the latter." In these mediums sufficient delicacy, symmetry, speed, and continuance, may, he thinks, be secured without any of the disadvantages attendant upon full blood. The produce of three-parts bred mares and race-horses have, he says, too generally all the disadvantages of the latter, without the benefit of their peculiar qualifications. And, he adds, that "the ancient prejudice of the superior fitness of the land of one English county above another for the production of hackneys, and the supposed pre-eminence of Yorkshire, Northumberland, and Durham, has been of late years fully and completely exposed. The Isle of Ely, Norfolk, and Suffolk, have for some years past, he says, bred the best hacks and the fastest trotters in England. It follows not, however, from thence, he thinks, that equally good stock may not be bred in any of the other counties, provided they have as good stallions and mares, and pursue the business with as much industry," attention, and regard to good keep.

HAG, a term provincially signifying a coppice, or, perhaps, originally, wood set apart for fuel.

HAGSNARE, a word signifying, provincially, a stool or stub, off which coppice-wood has been cut.

HAGWORM, a word provincially applied to the adder, which is venemous, and delights in new-cut coppice-woods.

HAIN, a term provincially made use of to shut up, as pastures from being eaten by stock. In Norfolk, it likewise signifies to raise or heighten, as applied to the sea, rick, or ditch.

HAIR, the fibrous substance covering the bodies of different animals, arising from their skins. It is their natural covering or coat, and may properly be reckoned one of the common integuments, not only for its use, but also because it is to be found upon all the parts of the body, except the soles of the feet. It grows longest upon such parts as most immediately need this kind of defence from accidental injuries. When hairs are examined with a microscope, they are found to have each a round bulbous root, which lies pretty deep in the skin, and which draws their nourishment from the surrounding fluids; and often each hair consists of five or six others, wrapped up in a common tegument or tube. They grow as the nails and hoofs of animals do, each part near the root thrusting forward that which is immediately above it, and not by any liquor running along the hair in tubes, as is the case with plants. Their different colours cannot be accounted for. The use of the hair is at once calculated for a covering and an ornament to the body of an animal.

The refuse hair of different sorts of animals has been found to be useful as a manure, when procured in sufficient quantity, such as that of hogs, &c.

Hair-*Grass*, a coarse sort of grass, of which there are several species, but which are not much in use as cultivated grasses, though some of them are eaten by cattle. See *Aira*.

Hair-*Staring*, in *horsemanship*, that condition in horses, in which the hair bristles or rises upright. It is mostly owing to their being badly kept, ill curried, not well covered, and too coldly housed.

In order to make the hair of a horse smooth, sleek, and soft, he should be well kept, and sufficiently warm, for the least cold will cause the hair to stare: as the sweating, in such cases, loosens and raises the dust and filth that renders their coats foul, when they are in the height of sweating, the white foam and filth that is raised up, should be scraped off with an old sword-blade, which may lay the coat even and smooth, observing to curry and dress them well at the same time.

Hair falling or shedding from the mane or tail of a horse, is generally said to be caused either by an overheat, that has produced a dry mange, or from a surfeit, which causes an affection of those parts.

In order to cure this complaint, anoint the horse's mane and crest with black soap, or make a strong lye of wood-ashes, and wash it all over with it.

HAIRIT, provincially, a term signifying cleavers.

HAIROUGH, provincially cleavers.

HAKES, a word provincially applied to the copse or draught-irons of a plough. It is likewise applied to pot-hooks.

HALF-*Husbandry*, that sort of arable management in which two sorts of crops are grown and cultivated on the land at the same time, as oats and potatoes, wheat and potatoes, &c. In the trials of the Rev. Mr. Close, as stated in the third volume of the Bath Papers, it was found to answer well, and he advises it as an useful practice on lands at a great distance from the stables and cow-houses, where the object of carting is of much consequence. See *Husbandry*.

HALLIER, provincially a person who carts or hauls for hire.

HALT, in *farriery*, a limping or lameness in animals from various causes.

Foot-Halt, in *farriery*, a troublesome disease in the feet of sheep, supposed by some to arise from a sort of insect of some length, which has a vermicular appearance. It shows itself by lameness, and the animal being prevented from feeding. The sheep becoming languid, weak, and emaciated, from want of food, and the great pain which it suffers, when the cause is not quickly removed.

As soon as a lameness is perceived, the foot should be carefully examined in the cloven part between the claws, where an opening may be found, through which the insect has made its way upwards between the bone and integuments. In order to remove it, the claws should be wrought backwards and forwards, till the insect is forced out on the surface, which by some is supposed better than the practice of drawing it out, from the danger of its being broken in the operation, and much injury done to the foot of the sheep in consequence of it. Much advantage may likewise be obtained in the prevention, as well as cure, of the disease, by putting the sheep in dry pastures, as it mostly occurs in the damp moist seasons of autumn and early spring, and in low moist meadow or marshy situations.

HALTER, a rope so formed as to be put on the heads of horses or other animals, in order to lead or tie them up by. It likewise signifies a head-stall of leather, mounted with one and sometimes two straps, with a second throat-band, if the horse is apt to unhalter himself. The string or strap of the halter may also be a long strap of leather, made fast to the head-stall and to the manger, to tie the horse.

Halter-*Cast*, in *farriery*, an accident occurring to horses from the halter being left too long when tied to the block, and in which an excoriation of the pastern is produced, by its being entangled about their feet, on their endeavouring to rub their necks with their hinder feet. In order to prevent accidents of this kind, a spring-staple has been contrived for the halter-ring to hang in. It is represented and described in the second volume of the Repertory of Arts, &c. and may be seen at *fig.* 1. *pl.* L. *a* is the spring passing through a mortise in the shank of the staple, close to the part screwed into the manger-rail, which, pressing against the lever *b*, keeps it short. Thus the horse, by pulling downwards on being entangled, overcomes the power of the spring, and frees himself.

Horses, that are apt to unhalter themselves, should always have a throat-band.

Where the parts are much bruised by these means, the use of saturnine discutient applications may frequently be necessary. And some advise the following as more useful:

Take of vinegar and brandy, of each an equal quantity; shake them together, and wash the part affected morning and evening, having first clipped away the hair; but be careful to keep the foot very clean.

Another easy remedy is, to wash the part with weak alum-water. If the fetlock of the horse be much inflamed, apply the following poultice:

Boil turnips till they are tender; squeeze out the water, and chop them in a wooden bowl, with two or three ounces of hog's-lard; put this into a cloth, and tie the foot in it, leaving it all night.

HALTING, in *farriery*, a lameness or irregularity in the motion of horses, arising from a hurt in the shoulder, leg, or foot. Halting happens sometimes before, and sometimes behind; if it be before, the hurt must of necessity be in the shoulder, knee, flank, pastern, or foot; but, if in the shoulder, it may be towards the withers, or in the pitch of the shoulder, which may be known by the horse drawing his leg a little after him, and not using it so nimbly as the other.

If he cast it more outward than the other, it is a sign that the disease lies in the shoulder. By taking him in the hand, and turning him short on either hand, he will sometimes complain of that shoulder he is lame in, and will either favour that leg, or trip in the turning. It may also be seen while standing in the stable, by his holding the lame leg out more than the other. If, when upon his back, he

complains more than otherwise, the complaint certainly lies in the withers.

When he treads thick and short before, the disorder is said to be in the pitch of the shoulder, close to the breast, which may be further discovered by setting the thumb and pressing it hard against the place, and thrusting him with it, on which he will shrink and put back his leg, foot, and body. If in the elbow, it may be known by pinching him with the fore-finger and thumb, as he will hold up his leg, and offer to bite; but if in the knee, it may be seen by his stiff going, as he will not bend it so nimbly as the other. If in the flank or shin-bone, it may be seen or felt, being a back-sinew, splinter, strain, &c.

When in the bending of the knee, it is a malender, which is also easily discovered.

Further, when the pastern or joint is affected, it may be known by the horse not bending it so well as the other, and if the hand be put upon the place, it will feel very hot. When in the foot, it is either in the coronet or sole; if in the coronet, it probably proceeds from some strain or wrench; but if in the hoof, from some over-reach or distemper in or about the frush. When in the sole, from some prick, nail, &c.

After the nature and seat of the disease has been fully ascertained, suitable remedies must be applied, according to the circumstances of the case.

HAM, provincially a stinted common pasture for cows, &c.

Ham, the name of the hind leg and thigh of the hog and some other animals, when prepared by being salted, smoked, and dried. The method of performing this, in the districts most celebrated for good hams, is sometimes to rub them very hard at first with bay, or other salt, but mostly the former; after which, it is the practice of some to let them remain on a stone bench, in order that the brine may discharge itself; while others cover them up close. In the course of a few days, they are again rubbed as hard as before, with the same sort of salt, mixed with about half an ounce of salt-petre to each ham. When they have continued about a week longer on the bench, or in the salting-tub, among the brine, they are mostly hung up to dry in the sides of large open chimneys; some having them exposed to the smoke of peats, coals, or other sorts of fuel, while others carefully avoid having them smoked. And when not sold sooner, are continued in these situations till the approach of warm weather, when they are packed up in casks with straw, or the seeds of oat-meal, and sent for sale. According to the Survey of the County of Westmoreland, hams lose 20 per cent. of their weight, in drying. This is a fact which the farmer who fattens many pigs should consider well before he enters on this system of management. See *Swine*.

Ham-*Trees*, provincially applied to hames of team-horses.

HAMES, the iron or wooden harness, by which draught-horses are attached to the carts, &c.

HAMWARDS, a word provincially applied to straw or rush-collars for horses.

HAND, the measure of the fist when clenched. The height of horses is computed in this way. A good sized horse is from fifteen to sixteen hands in height.

Hand-*Beating*, provincially signifying the operation of paring the sward for burning with a beating-axe, or large adze.

Bridle-Hand, in *horsemanship*, the left hand of the rider.

Fore-Hand, in *horsemanship*, signifies the fore-parts of the horse, as the head, neck, and fore-quarters.

Hand-*Gallop*, in *horsemanship*, a sort of short easy gallop.

Hind-Hand, in *horsemanship*, signifies the hind-quarters.

Hand-*Hoe*, that sort of hoe which is wrought by the hand. See *Hoe*.

Hand-*Hoeing*, that kind of hoeing which is performed by hand. See *Hoeing*.

Hand-*Mattock*, a tool of the pick-axe kind, advised by Mr. Nicol as very useful in clearing the ground for sowing acorns among planted trees. He describes it in this manner:

"The handle is eighteen inches long, the head about fifteen, having one resembling an adze, four inches broad in the face; and the other, a pick about ten inches in length, tapering and sharpened at the point. It resembles a *tomahawk*, with the face of the axe reversed, so as to cut at right-angles with the handle."

Hand-*Reaping*, provincially signifying ordinary reaping by hand, in contradistinction to that by the scythe.

Hand-*Weeding*. See *Weeding*.

HANGING *of Gates*. See *Gates*.

HANK, provincially a withe or rope for fastening a gate. It likewise signifies a skin of yarn.

HAP, provincially a covering, as seed with mould or earth.

HAR, provincially applied to a strong fog, or drizzling rain.

HARD-*Iron*, provincially applied to the weed corn crow-foot.

HARDS, provincially coarse tow.

HARE-*Mist*, a thin sort of mist. See *Mist*.

HARLED, provincially signifying mottled or speckled, as applied to neat-cattle. It also signifies the dashing of walls, lime and sand, &c.

HARNESS, the traces, trappings, or furniture of the horse, or other animals employed in draught.

Harness-*Galls*, in *farriery*, are hard lumps or bunches. It is sometimes produced in the breasts of horses by the galling of the harness, especially when much wrought in rainy weather. In these cases, the application of vinegar-grounds, or saturnine washes, may be beneficial. And, in order to heal the sores, the hair, if long, should first be removed from about the part; then the whole breast be washed with a lather of water and black soap, and afterwards that part of the breast which is covered with hardened matter, be bathed with salt and

water, suffering it to dry of itself. If the pressure from the hardness of any part of the harness occasions the galling, it should be removed by proper stuffing.

Harness-*Room*, a place appropriated for the purpose of keeping harness in. It should be perfectly dry, and situated as near as possible to the stable.

HARROW, an implement used in the tillage of land, both for the purpose of breaking the clods of earth, and covering the seed when sown. It is a sort of framed wooden drag, mostly made in the form of a square, with iron teeth or tines. And there are different sorts of harrows employed by farmers, such as the single and the double brake, and other harrows.

These implements should always vary in size and weight, as well as in length of tines, according to the nature of the land upon which they are to work, and the intention with which they are used.

These useful tools in the cultivation of land have hitherto undergone but little improvement, as the chief circumstances in which they have been rendered more applicable and convenient, seem to be in the position and mode of fixing in the tines or teeth, the direction of the bulls, and the manner in which the horses are attached in drawing the implements. It has been suggested by the author of the Gentleman Farmer, that no one harrow, whatever its construction may be, can be suitable for every sort of soil, or can act with equal effect on such grounds as are rough and smooth, or firm and loose: they must be adapted to the nature of the land, and the particular purposes the operator has in view. It is sufficiently evident, that in the lighter sorts of land, a small light harrow, with short tines or teeth, may be sufficient for the purpose; but in strong, heavy, and tenacious soils, or such as have been newly broken up from the state of old leys, or from a state of nature, such as commons, moors, and wastes, a harrow which has a much greater weight and longer teeth is to be preferred; and even where the land is rough and not easily reduced, as in the fallowing and reducing of strong clays, two harrows combined with each other, may frequently be proper and necessary, in order to fully separate and break down the cloddy soil. And for these uses, it has also been found better, especially where the land is stiff, tenacious, and abounds much with the roots of weeds, that the harrows should not be too thickly set with teeth; as under such circumstances, where they have a number of teeth, they not only soon fill and choak up, which prevents them from working, but are confined too much to the surface, by which the soil is very imperfectly broken down and reduced into a state of powdery fineness.

And as, in the work of harrowing, much time is found to be often lost in turning at the ends of the ridges, where two or more common harrows chained or otherwise fastened together are made use of, by their hitching or getting upon each other, or turning over, requiring the driver to stop in order to put them right again; it has been the case, in order to remedy this inconvenience, to have harrows contrived with running bulls, a mode of construction which has been found to answer such intentions in a perfect manner. And it has been suggested, that this inconvenience may be corrected in a much easier and less expensive way, merely by fastening the instruments to each other by means of proper hooks and eyes, or what are termed coupling-irons in some places, by which contrivance the different harrows rise and fall at the same time, and are kept from ever getting upon each other. Something has likewise been done in respect to the position of the teeth, so that they may not move in the same line of direction with each other. This has been attempted in different ways; but the most simple, easy, and expeditious contrivance is, perhaps, that of having the harrows so formed, as to be some inches narrower before than behind, and at the same time to be capable of being set to different widths, so that the distance between the teeth may be regulated by increasing or diminishing the distance between their fore and their hind parts. And in common harrows, it may in some measure be effected by being so attached to the horse, or moving power, as to be drawn over the land somewhat in a diagonal direction. And in the construction or forming of all the larger sorts of harrows, it is of the utmost importance that the tines, or teeth, have a slight inclination forwards. By these different alterations in the construction of harrows, they are found to be capable of doing a great deal more work, of keeping more closely to the ground, and of cutting as well as tearing up more effectually such weeds as they meet with in the execution of the work.

Some have likewise advised it as "a good practice to have the teeth, at least of large harrows, fastened into the bulls by means of nuts and screws, in such a way as that they can be removed with facility when necessary; or, perhaps, a still better method is, to have the heads of the teeth made square, and put upwards into the bulls, having long holes in the parts that come above them, into which, square wedges may be put, in order to keep them fast, and prevent their being lost" in performing the business, as is often the case, by which much expense is caused to the farmer.

Besides these modes, harrows have sometimes been constructed with teeth of unequal lengths. The first row, for instance, being a quarter or half an inch shorter than the second, and so on with respect to the rest. These harrows have been said to do more work, and to be more readily cleansed from weeds and other substances, by which they are liable to be choaked up. It is said, that harrows, formed in this way, are in common practice in some parts of Devonshire, and have been since introduced into Leicestershire with advantage by Mr. Handford, an ingenious mechanic in that district: And such harrows have been constructed in various ways, with a greater or less number of bars or bulls, as from three to five or six, the number of teeth varying of course in the same manner.

It is now, among the intelligent cultivators of land,

mostly found, that single-horse harrows are more beneficial than such as require two horses. In the attachment of them to the power by which they are to be drawn, the most usual method is by a strong sort of staple, fixed to one of the corners of the harrow by a bolt; but a plan, which appears more convenient, is that of connecting the muzzle with a perpendicular pin to one corner of them, as by this method they are used with greater ease.

In order to obviate the difficulties of turning at the ends of the ridges, and lessening the weight on the backs of the horses, wheels have likewise been added.

The *single* or *common* harrow is a well-known implement, which requires little description. It mostly consists of four bulls or bars, with four or five teeth or tines in each. It is lighter in the construction than any of the other harrows, being easily worked by a single horse: harrows of this kind have generally the same number of bulls and tines as those mentioned below; and, in regard to the manner of working them, it is nearly the same, and will be afterwards taken notice of. The common single harrow is represented at *fig.* 1. and an improved harrow of the same sort is seen at *fig.* 2. *pl.* LI.

The *double* harrow is formed by merely joining two harrows of the ordinary size together, by means of crook and loops; each has generally four bulls, and six tines in every bull. It is in very general use in some counties for the purposes of the brake-harrow, and also supplies the place of the common harrow, but is not so easily worked, frequently requiring three horses or more.

The *brake* is a large heavy kind of harrow, which mostly consists of four bulls, in each of which there are five or six long tines or teeth. This implement is extremely useful for reducing rough strong land, and bringing it into cultivation; and for loosening couch-grass, and other root weeds, in the course of a summer fallow. It is frequently used after seed is sown, and before the light harrows are introduced. The brake-harrow is commonly drawn by three or four horses; but, in some districts, by two horses and two oxen.

These sorts of harrows have been much altered, and rendered more convenient and easy in the draught, by different persons. In Ireland, Mr. Parkinson found it useful to have a large and small harrow of this kind, which were wrought with one horse. The large one had, he says, "thirty-four teeth, of eleven inches long; the slots before were two feet six inches in length, and were drawn by one horse; they were put together with iron hooks and eyes, at the same distance as each bull was from the other; and, in this way, he found them to require much less force to draw them than otherwise; for when they were first made, the smith, by mistake, made the distance between each harrow very short, and they worked very badly, being hard work for two horses, each equal in strength to the one horse that worked them after the improvement. He mentions this circumstance, in order that the farmer may take care to make the harrows wider behind than before; for, by so doing, the harrows leave the mould, and gather the couch, &c. The teeth must also be raked or put forwards, as may be seen by the drawing: and this is another necessary observation; for, by the point standing forwards, and not perpendicularly, they do not rise out of the ground when they meet with an obstruction, and they pulverise the ground more by being put in that direction." And "the small harrow is drawn by one horse, and made in the same manner, but with the teeth shorter; by which means it takes away the small lumps of rubbish, which the large harrow leaves, and acts as a couch-rake, whilst it does not gather so much mould up as those rakes do. He has used a horse-rake for this purpose; but, on land where there are many stones, it would not do at all; for where he used it, it gathered such a quantity of mould amongst the rubbish, that it required a great deal of labour to shake away the mould before the rubbish could be burnt or carried off. This harrow is represented at *fig.* 3. where *a* is the hook and bridle moveable; *b*, the iron across the two bulls, with holes in it for the bolt of the bridle, if it should be necessary to alter its position; *c d*, the hooks and eyes to keep the two harrows together, and bolts through the three bulls, with screws and nuts; *e f*, the two fore-slots in each harrow; *g h*, the two hind-slots; *i k l*, the three bulls in the foremost harrow; *m n o*, the three bulls in the hindermost harrow, with caps at the upper ends to keep the bulls together, and cause them to slide by any obstruction; *p*, the handles, by which to lift or bear on the harrows; *q*, one of the teeth, to show the form in which they ought to be made, with a screw and nut to fasten them."

The small harrow differs in no respect whatever from the large one, but in the size and weight: it may, therefore, be readily constructed by any workman, from the representation of the large one.

The writer remarks, that "from the bridle being moveable, the person using it has an opportunity to move it, so as to prevent the harrow from rising in the joint, and to enable it to bend in passing into hollows and over hillocks. And the advantage of harrows being of greater length than is usual, in that part termed the joint, is, he thinks, that they not only require less power to draw them, but also do their work better. The difference in length of the teeth between the large and small harrow has, he likewise supposes, an advantage; as, from the former being nine inches and a quarter, and the latter seven and a quarter, they follow each other so as to bring all sorts of rubbish to the surface, and cut or divide the soil into fine order. Their being wider behind than before has also, he thinks, an additional advantage to that mentioned above, which is, that the teeth cannot follow one another; while they do not divide so much as to occasion them, as in the old harrow, to rise out of the ground; which is likewise further prevented by their crooked form, only varying so as that the fore teeth may loosen the earth, and those after them follow with ease, so as to shred the land one after another as they go along.

Another method of constructing and connecting harrows, so as to form double ones for two horses, is shown at *fig.* 4, in which *a* is the bar by which the harrows are united, by means of screws and nuts at *s s*; *b b*, the places and manner of attaching the draught to the harrows; *cc*, the manner in which the horses are attached in drawing them. Harrows of this sort have been much in use in the northern parts of the kingdom, and are capable of being made use of with one horse in a separated state. These harrows, of course, become very useful tools for many uses in tillage-husbandry.

Another sort of useful harrow has been constructed under the direction of Mr. A. Young, which is wholly of iron, having found, from experience, that those formed of wood are very liable to drop to pieces, as well as to be too light for many uses. The teeth in his harrow are made to screw through the double frame, separated by iron washers, for the greater steadiness. Handles are likewise attached to it, for the purpose of lifting it more readily, and for pressure. The implement thus formed has been found to answer in a perfect manner. It costs about six guineas, when complete; and the shape or form may be varied, so as to suit particular purposes.

In order to show the advantage resulting from an alteration in the position of the teeth or tines, it is observed by the author of the Agricultural Survey of Mid-Lothian in Scotland, that in the harrow *fig.* 1, which is always drawn in the direction of the line AA, the twenty tines make only eleven different ruts, as several follow one another in the same tract; and even those are not at all effective; for two on each extreme corner AAAA, are so unconnected with the others, as not to be accounted in the work, seven ruts only, as shown by the dotted lines, being found properly done: from this it happens, that one harrow, drawn by itself, covers only three feet of ground; two cover but about six; and three, which does however more in proportion, cover only ten; whereas in the improved harrow *fig.* 2. although it has only sixteen tines, yet, as each tine makes a separate rut in the direction of the dotted lines, one harrow, drawn by itself, will cover four feet and a half; two harrows about eight feet, and three cover twelve feet; at the same time the ruts are only three inches eight-tenths asunder; but, in the common harrow, they are six inches distant. It is added, that if, however, the common harrow were drawn in the direction BB, the twenty tines would make sixteen ruts; still, however, one on each side, at two opposite corners diagonally, would be non-effective: but, after all, this direction of draught is not practicable with any but one harrow at a time; for if two or more were yoked together, the dragging of the furthest off would interfere with that immediately before it. In the improved harrow, the dimension is a square of four feet, exclusive of the projection of the bulls at the ends. The imaginary lines AA show the direction of the draught; BB, is also an imaginary line, serving merely in the plate to point out the regular distance of the ruts; the figures at each tine show the distance in inches at which they should be inserted from the ends of the bulls.

In many districts, where the common single harrows are used, a man, Mr. Donaldson observes, drives three horses, and every horse draws his own harrow. These, when used together, are prevented from getting above one another, by placing a bar of wood across, provincially called a *lay-over*; or by a piece of crooked timber fixed to the outside bulls, that are contiguous to each other, which prevents the harrows from starting up, and keeps them in their proper places. These harrows, joined together in the manner above-mentioned, or by any other means used to prevent them from getting out of their places, is, he conceives, the best manner in which they can be worked. But a man, with three horses, and three single harrows, will, he assests, do nearly, if not fully, as much work, and to as good purpose, as four horses in pairs, and two men, are able to perform. This, no doubt, is a strong argument against using double harrows; and whoever will fairly try the experiment, will, he thinks, be perfectly satisfied of the fact.

In some districts, in both the northern and southern parts of the kingdom, small light harrows, with short tines set pretty close, are used for harrowing in grass and other small seeds; and this method should be more generally practised than it is. On lands in proper tilth for receiving grass-seeds, these harrows not only make the mould finer, but also cover the seeds at a more proper depth, and in a more complete manner, than can be done with those of the ordinary size. This description of harrow may be made from any of the common harrows of the smaller light kinds, by having the teeth set more closely, and considerably smaller in size, and shorter.

Mr. Knight's improved harrow, with a frame of wood and wheels, has been recommended by some; but such tools, however ingenious in their construction, can never be of much practical utility. This harrow is so contrived as to be capable of being moved higher or lower, as may be desired, and is the invention of a farmer of that name at Great Barfield, Essex. It may be applicable, in some particular purposes of cultivation, on the drier sorts of soils.

Mr. Lister and Mr. Wynn have made what are said to be improvements of this kind of implements, which may deserve the attention of the farmer, in particular cases. The former on a large heavy sort of harrow, which may be beneficial in new broken up lands.

The harrow and roller have also been united: by this means a saving of a man and horse is said to be made. It is the invention of Mr. Benjamin Young, a farmer in the Isle of Wight. Many other large kinds of harrows or drags are often made use of.

Bush-HARROW, a sort of harrow formed by the interweaving of some sort of brushwood into a kind of frame made for the purpose, and raised in the fore part by two small wheels. It is often made use of for the purpose of putting in small seeds, as well

as for harrowing in dung, or earthy composts, into grass-lands. See *Bush-Harrow.*

The *Triangular* Harrow, is a sort of harrow that has been made use of, by some, with advantage for clearing the intervals between bean-rows from weeds. It is seen at *fig.* 5, where AB are the frames, and E the copse by which it is drawn. A better implement for this purpose is represented in the plate on Horse-Hoes.

HARROWING, the action or operation of the harrow. This process is performed for different purposes, as those of reducing and pulverising the soil, as well as smoothing the surface after ploughing; but the chief design is to cover the various kinds of grain and other seeds when sown. It is, also, a very effectual mean of cleaning the ground of all kinds of weeds. For the first and last purposes, the heavier sorts of harrows are mostly made use of; but, for covering the seeds, the lighter kinds are generally to be preferred.

It is observed by the author of Modern Agriculture, that every intelligent farmer knows the advantage resulting from having the surface made smooth, and the mould properly broken and pulverised after seeds are sown, as thereby they derive greater nourishment, and the moisture is more effectually retained. It is also obvious, that strong land requires more harrowing, in order to reduce it to a pulverised state, than lighter soils; but as all soils are rendered more firm and solid by harrowing, the less a strong soil is harrowed, if the intention is answered, the better. On the other hand, a light spongy soil, especially where there is any portion of moss, being rendered more compact and retentive of moisture by harrowing, is a kind of land that can scarcely get too much. It may likewise be remarked, that light gravelly or sand soils should be as little as possible stirred by harrowing in dry weather; and those of the more stiff and wet descriptions but little touched in wet.

It is added by the writer just mentioned, that after the seed is sown, the common method of harrowing is first along the ridges, then across, and then along again. When the ridges are level, or nearly so, they may be harrowed either way, as the farmer may find most convenient, it being of little consequence whether the harrow go first across or along the ridges of a well ploughed field in proper tilth; but, if the ridges are raised in the middle, and the land indifferently ploughed, it would be highly improper to begin by harrowing across; as thereby a considerable share of the seeds would fall into the bottoms of the furrows, and be prevented from vegetating.

Where the intention of harrowing is to tear up the roots of weeds, which have been in some degree loosened by the previous ploughing, the harrows will do much more execution by going in an opposite direction to that in which the plough went; as the tines or teeth will tear up a greater quantity of the roots, than if the harrows followed in the same direction with the plough.

But when harrowing is performed for the purpose of destroying seed-weeds, the surface should be made smooth, and the soil as much reduced as possible. The seeds near the surface will, by this means, vegetate with more freedom, and in greater abundance; and thereby a second or third harrowing will have much more effect in cleaning the field.

It is further added, that there is another circumstance, in regard to harrowing, which ought not to be omitted. It often happens, that after a field has been properly summer-fallowed, manured, and prepared, in the best manner for sowing wheat, the farmer is prevented from so doing by heavy falls of rain. Though no water may appear on the field, yet it is rendered so poachy, that he cannot put on his horses for the purpose of harrowing in the seed; and that circumstance alone prevents him from sowing his wheat in due season. In some parts of Scotland, a method has been tried to remedy this inconvenience; which, when the ridges are straight and not over broad, or too high raised on the crown, has been found to answer beyond every expectation that could be formed. It is as follows:—An axle, equal in length to the breadth of the ridge, is fixed on two cart-wheels; and to this axle is chained as many harrows as will cover the breadth of the ridge. To each of the ends of the axle, two horses are yoked, and made to walk along in the furrows of the ridge: the wheels turning easily round, and following the horses in the furrows, the horses' feet are by this expedient prevented from doing any injury, and the seed is as effectually covered as in the ordinary way. The only additional circumstance necessary to be mentioned is, he says, that the harrows should not be turned short at the end of a ridge. In order to avoid confusion, it is better to go along one ridge, and return by another, which may be done as often as is judged requisite for harrowing the field in a sufficient degree.

It is remarked by Mr. Middleton, in his Survey of Middlesex, that, in that county, harrowing is a tedious business. The pace of the horses is disgusting; the harrows so often hitch one on to the other, that the man is obliged to stop a fourth part of his time to set them to rights. This might, he thinks, be prevented by placing a board of six or more inches wide edgeways upon the right-hand bull of each harrow; or, what perhaps is better, by coupling them together with hooks and eyes, and by driving the horses with whip-reins, of sufficient length to admit the man to walk after the harrows (as is the case on the borders of England and Scotland, and in Norfolk and Suffolk). They would, as a necessary consequence, he says, harrow four times as much land in a given time as by the present method, and it would be done much better than it now is. The pace of the horses must, in a great degree, be regulated by the nature of the land; but the driving by means of long reins, so as to walk behind the harrow, is an extremely good practice.

HART-CLOVER, a term applied to melilot. See *Melilot.*

HARVEST, the season of cutting down and carrying the grain or other crops.

The time of harvest, both for hay and corn, commences at earlier or later periods, according to the state of the climate, the nature and qualities of the land, and the peculiarities of the situation and crops. The northern districts are, however, generally later by a month or six weeks, in both cases, than those of the south. The hay-harvest is seldom, however, completely finished before that of the corn is begun; though, in most districts, it is nearly so. See *Hay*.

Corn-HARVEST, the period in which grain becomes in a state fit to be cut down and preserved. It is remarked by the author of the Present State of Husbandry in Great Britain, that "the difference in the periods at which the corn-harvest usually begins in the various districts of the kingdom, is very considerable; greater, probably, than what takes place in any other country of the same extent in Europe. Almost every district, he says, varies from another in this particular; insomuch that the ordinary duration of the British harvest cannot be reckoned at less than three months. It commonly, he says, begins, in the southern and midland counties of England, about the latter end of July, or the beginning of August; and, in the northern parts of Scotland, about the first or second week in September. In these last mentioned districts, it is seldom finished, even in favourable seasons, till towards the end of October, and frequently not till the beginning or middle of November. See *July* and *August*.

And "scarcely more various, continues he, are the periods at which harvest commences in the different parts of the island, than are the modes in which the several operations incident to that busy season are performed. In some, the corn is cut with a sickle, and bound up into sheaves; in others, the operation of cutting is performed by the scythe, in some way or other, and left unbound. In some places, too, the grain is set up into hattocks, and covered and capped; in others, it is not: and, in some, the crop is cut high; while, in others, this is done as close as possible."

It is observed by Mr. Marshall, in the Rural Economy of Yorkshire, "that no department in rural economy distinguishes the northern from the midland and southern parts of the island, so much as the method of harvesting. And, perhaps, no northern district is more strongly marked with this distinguishing characteristic than this.

"It is probable, says he, that nine-tenths of the corn, which is cut within this kingdom, is cut by men. In Surry and Kent, a woman may sometimes be seen with a sickle in her hand. In Norfolk, it is a sight which is seldom or ever seen. Here, it is almost equally rare to see a sickle in the hand of a man reaping, provincially *shearing*, being almost entirely done by women. Three women and one man make a set, who, if a middling crop, do an acre a day. If corn be thin, a man will bind after four women; if very thick upon the ground, he requires a boy to make bands for him.

"Sometimes the bands are laid for the women to throw their handfuls into; but, in general, they lay the corn in reaps, of about half a sheaf each, the binder gathering it up carefully against his legs, in the manner wheat-straw is usually gathered on the threshing-floor. This is much the best way, though somewhat more troublesome, the corn being by this means bound up tight and even, and the sheaves made of an equal size."

It is added, that "the day-wages of a woman in harvest is 10*d*., of a man 2*s*. Thus wheat, which in Surrey would cost 10*s*. to 12*s*. and which, in any country he has observed in, would cost 7*s*. to 8*s*., is here cut for 4*s*. 6*d*. an acre." It must however be remarked, that, since the above was written, the price of labour is greatly advanced; 1*s*. or 1*s*. 3*d*. per day for a woman, and 3*s*. per day for a man, is about the average price now (1798), given for labour in harvest.

But, says he, "the saving of so much an acre is far from being the only advantage arising from the practice of employing women in the work of harvest; the number of hands is increased; the poor man's income is raised; the parish rates are in consequence lessened; and the community at large are benefited by the diffusion of a habit of industry, and an acquisition of health. How conducive to this are the employments of husbandry compared with those of manufactures! and the work of harvest, so far from being thought a hardship, is, by women who have been bred to it, considered as a relaxation from domestic confinement and less agreeable employments."

HARVESTING, the art of cutting and securing the corn or other crop. It is observed, by the author of the Present State of Husbandry in Great Britain, that, "in the method of harvesting crops, peculiarities will be found attached to almost every district; some of which, if attempted to be introduced into others, would be considered as improper, and, in some, as absurd. Whosoever, for instance, should recommend to the farmers of Sutherland and Caithness, in Scotland, the methods of mowing and harvesting corns in swath, or in cocks, as is practised in several of the English counties, would infallibly, he thinks, expose himself to the riuicule of the sensible and intelligent. Every farmer must know, that the method of harvesting a crop, which does not come to maturity till October or November, ought, from the usually precarious state of the weather at that season, to be very different; and that more precaution is necessary to preserve it from injury, than what is requisite in July and August, when the day is so much longer, and the sun possesses superior influence. This observation, though it does not account for all the various modes in which the crops of grain are harvested in the kingdom, many of which are, he conceives, continued rather in consequence of long habit and early prejudices, than from a conviction of their expedience, is, notwithstanding, a satisfactory reason why more precaution is requisite in the northern parts of the island, than is considered necessary in the south and east divisions. In the latter, the harvests, as has been seen, commenced at an early period, and the husbandman has, of course, but little to apprehend from long

continued periods of unfavourable weather, or the sudden approach of winter."

But in whatever manner the business of harvesting may be conducted, as bad weather must greatly affect the profits of the farmer, especially with wheat, he should constantly be careful to have a sufficient number of hands at work, to make the most of fine seasons; as, without that, he will sustain loss, and have the epithet of *afternoon-farmer* applied to him.

The crops of wheat and rye are almost every where cut with the sickle or reaping-hook, an instrument that seems to have been used for the purpose from the earliest periods. And the operations are performed in different modes, and at different heights, according to the particular custom of the districts.

In some of the midland counties, and in several of those on the south-east coast, the crops of wheat are cut at the height of twelve or fifteen, sometimes eighteen inches from the ground. The handfuls, as they are reaped, are laid on bands, made of some reeds of the crop, knotted together, near the ears, in the ordinary way. These parcels, being bound up into what are called sheaves, are either allowed to lie on the stubble for a few days previous to their being carried home to the barn, or they are set upon their bottoms in double rows, the heads of the one sheaf inclining towards that of the one opposite, and forming, including the base, an irregular triangle. When the crop is carted off, the stubble, in these cases, is mown with a scythe; and, being raked into heaps, is carried to the farm-yard, and either used for thatching houses, or corn or hay-stacks, or as litter. But in the north and west of England, and in every part of Scotland, where wheat and rye are cultivated, the crops are reaped as near the ground as can be conveniently done; and the sheaves, after being bound, are set up in shocks, provincially *stooks*, consisting of a double row of five or six sheaves on each side; over which, in most districts, two sheaves are placed in such a manner, as to cover the tops of those in the stook. These are called hood or cap-sheaves, and, when placed judiciously, have a surprising effect in preventing even very heavy rains from wetting or materially injuring the grain below.

In some places, the hood-sheaves, being placed on the stook with their root ends uppermost, have their heads carefully spread over the top of the stook: the ears thus reclined are safe from injury by wet themselves, and preserve also from almost any rain that can fall on the stooks which they cover. And, in order the better to preserve the hood-sheaves thus placed in their situation, a few straws, the usual thickness of a band, are taken from each side, but below the band of one sheaf, and form together a band, which, being carried round the other, binds them fast together, and consequently keeps both in their place.

It is however remarked, that this practice of hooding or covering the tops of the stooks must, in any climate, considerably retard the completion of the harvest; as the crop, in that case, cannot be so soon ready for being housed or put into stacks, as when it is fully exposed to the influence of the weather. The propriety of using this precaution, in order to guard against the consequences of bad weather, must therefore depend, in a great degree, on the period at which the crop is reaped, the state of the weather at the time, and the general nature of the climate in the particular district. In all these, there is frequently so great, and it may almost be added, he says, so uniform, a difference, that the measures, which an attentive farmer in some situations will find it prudent regularly to adopt, would be in others, if not improper, at least less necessary. To what, says the writer quoted above, but to the circumstance of the harvest commencing at earlier periods, and that the weather continues more uniformly favourable, is it owing that the farmers in the south of England never hood or cover their wheat in sheaf, and that this precaution is never omitted in the northern districts? If this variation in practice be not accounted for by the reasons above assigned, the writer acknowledges himself ignorant of the origin whence it sprung.

Mr. Marshall also remarks, that both practices are wrong: in fine weather, the ears of corn cannot be, he thinks, too much exposed to the sun and dews; if the grain be thin, a slight shower is of great benefit to it. In a rainy season, they cannot be covered too closely. Therefore, in the covering of wheat, as in many other departments of husbandry, the farmer, he says, ought to be directed by the season, not by the general custom of the county he farms in.

In Oxfordshire, and several other counties, they bind up their wheat in sheaves, though it be full of seeds, and set three sheaves somewhat sloping against three others; after which, they cover their tops with two sheaves, opened at their ear ends, which are extended and placed downward. In this situation, they formerly let their wheat stand three weeks or a month in the field before they carried it in; for no wet can hurt it, nor is it apt to grow in the ear when thus sheltered.

And in their wheat-pooks, as they call them in Wiltshire, the sheaves are set in a circle, with their ears uppermost; another circle of sheaves is placed upon that, and so on, contracting each round till the pile ends in a point; upon which a sheaf, opened and turned with the ears downwards, is placed, like the hackle of a hive; for an ear turned downward will not so readily grow, though much wet fall upon it; and the bottom of a sheaf being broader than its top, every upper one shelves over the under, like eaves of a house. A load, or two loads, may thus be put into a pook, which is a very good way to secure corn against rain, and to give the weeds among it time to dry. But, as Mr. Lisle rightly judges, this method is not altogether proper when the wheat is intended to be laid up in a rick; because, if the weather prove wet, mice will run to it for shelter, and will be carried in with the pooks.

It is added by Mr. Donaldson, that "the practice of leaving the wheat-stubble so long as to render mowing afterwards requisite, is also confined to the southern and midland counties; and that, although this be unquestionably a remain of the mode of har-

vesting introduced by the Romans, it does not appear worthy of imitation, being liable to many objections, which do not apply to the other and more generally established method."

It is well known, the writer thinks, to every unprejudiced farmer, who is in the habit of superintending reapers, that "the higher the crop is cut, the more heads and stalks are dropped; and whosoever takes the trouble to examine a field where a long stubble has been left, will find the loss of grain incomparably greater, than where the crop has been reaped pretty close to the ground. Besides, the reaping a crop of wheat, barley, or oats, of ordinary length and thickness, is not only better and cleaner, but also more expeditiously performed when cut near the ground. The reaper, by gently leaning the handful he has reaped against the standing corn, can go on to cut, and keep together with the greatest facility, a much larger quantity than he is able to grasp with his hand. Whereas, when the crop is cut twelve or eighteen inches from the ground, he must grasp the stalks before cutting, or they will infallibly drop among the stubble and be lost. In the former case, too, an expert reaper will, at every time he stoops, reap three or four times the quantity that can be done by the person who lays hold of every stalk. If to this be added the loss of grain and of straw, and the great additional expense of mowing, raking, carting, and stacking the stubble, it will probably be difficult, it is supposed, for the most zealous advocates for this mode of harvesting, if it be superior to the other, to point out wherein that superiority consists."

It is remarked by the author of the Agricultural Survey of the County of Perth in Scotland, that, "in the highland districts of that country, the reapers cut low, level, and clean, to a degree almost unknown in any other country,—a practice which he observed with pleasure in Athol, Breadalbane, and the adjacent districts; and which he earnestly recommends. Low shearing, says he, produces additional provender; and if all the straw is not required for the purpose of food, cattle will reject the coarse, which serves for litter, and, being trodden under their feet, makes an encrease of dung; whereas, if it be left in the field, by means of high shearing, you have less litter, and less dung. If a long stubble were to be ploughed in before winter, it might do good to the soil; but after it is bleached with wind and rain, and corroded with frost, all its juices, all its manuring virtues, are in a great measure lost." This practice no doubt originated, Mr. Donaldson thinks, from the idea that appears to have been entertained in former times, that in place of building the crops of wheat in stacks, as is now the ordinary method in the other parts of these kingdoms, it was indispensably necessary to house them. The force of prejudice, and a dislike to innovations of every sort, may, it is conceived, have tended not only to a long continuanee, but also to the general establishment of it. See *Reaping*.

It may be observed, that the reaping or cutting of these, as well as most other, sorts of grain, should be performed before they become too ripe.

"Some farmers," Mr. Young says, "leave their corn standing so long, that it is ripe enough to *cut* and *carry*, as they call it; that is, they cart home the sheaves as soon as they are bound: but this will only do for very clean crops."

It is observed by Mr. Somerville, that, in his district, "harvesting, with winter-sown wheat, is somewhat earlier than for other grains, with the exception of Dutch oats. Spring wheat is later, and, unless in unfavourable seasons, is cut with other grains. There appears to be some contrariety of opinion, he adds, amongst the East Lothian farmers, respecting the marks of ripeness in wheat, or the degree of it that is necessary to make a perfect sample; some assert, that cutting quick is the surest way of having the grain perfect; while others are of opinion, that it should be dead ripe; in other words, that the circulation, in both straw and corn, should be over before it is cut down. Perhaps truth is to be found between these extremes, an opinion sanctioned by the practice of the best farmers, who neither cut very quick, nor allow the wheat to be over-ripened. Observation points out the marks of maturity necessary for wheat, and indeed for every other grain; and these marks, when properly attended to, are sanctioned by experience. As long as the circulation continues through the ear, the grain is receiving something from the earth, and ought not to be cut: whenever that is over, the sooner it is cut down the better. The first mark of the circulation being at a stand, consists in a shrinking and whitening of the straw, immediately below the ear, which gradually proceeds downwards, till it reaches the bottom, when the grain, in provincial language, is said to be *dead ripe;* in that state the straw becomes brittle, the ears are easily broken off, and the grains shake out in the handling. To that stage it ought never to be allowed to come, as the loss of grain is not only great, even under the most favourable circumstances of calm and fair weather, but the quality is materially impaired by such a long and unnecessary exposure to the action of light and heat. It is a fact now well understood, that the nourishing and fermentable properties of all vegetable productions, whether grain or fruit, bear an exact proportion to the quantity of light and heat they have enjoyed, during their growth and ripening; the benefits derived from these continue to be felt while the circulation goes on; but, as soon as it ceases, these elements begin to take away what they had formerly given; the grain loses its colour and flavour, and has every valuable quality diminished. If it be overtaken by rain in that state, the injury is infinitely greater than what happens to grain that is cut at an earlier period.

"The period, at which wheat, and indeed all the white crops, ought to be cut, is when the straw begins to shrink, and becomes white about half an inch below the ear; the circulation is then cut off, and all farther benefit from its standing is at end;

the grain has taken every thing requisite to perfect it from the soil; and, as far as the value of the straw, whether for fodder or other purposes, is concerned, an advantage is gained by cutting it while the circulation is going on, and by that means preserving a part of the natural juices; the value of straw, like that of hay, depending upon the proportion of natural juices it contains, and the pains that have been taken to preserve these."

Wheat, which is full of weeds, ought to be cut three or four days sooner than ordinary, that the weeds may have time to wither before the corn become too ripe; for if it be not cut till the grains are full ripe, it will be liable to considerable damage by shedding, loss of colour, and injuries from rain, whilst it remains exposed for the weeds to dry. A single shower, or even a day's gentle rain, whilst it lies in swath, is indeed thought, by some, to be rather beneficial to the grain, by making it feel dry and slippery, and thresh the better; but all possible care should be taken to guard against its being wetted too much. When, through any unavoidable accident, it is laid up, though it may not take much harm in the mow, it will sweat, and cling together, when laid in a heap after being threshed, and look as white with mouldiness, as if it had been strewed with flour. Such corn will not keep, and therefore should be sent to market and sold as soon as it is threshed.

But though most corn is thought to be bettered by lying a short time in swath or grips, to take the dews which contribute to render its grain plump and of a good colour, yet its straw becomes thereby the worse for fodder, unless it was cut before it had attained full maturity, and lies out no longer than till it be sufficiently ripened. However, in hot dry summers, when the corn ripens fully, and its own vigour gives it a proper colour, and plumps up the grain so that the husks readily yield their contents when threshed, wheat need not lie out in grip before it is sheaved or in sheaf, unless it be full of grass or weeds; but, in cold wet summers, the wheat is sometimes horny and pale, the grains are thin, and require being plumped; and their husks cling so close, that they may require to be mellowed, in order to make them thresh well. The full grain, which swells the chaff even till it opens, in good and fruitful years, is almost bare to every moisture, and the heavy ears then spread and hang over the sheaf, which of course opens wider, and lets the rain into bands sooner than in less kindly seasons, when the wheat being light, the ears in the shock stand more upright and closer together.

In proportion to the heat of the weather, greater expedition is necessary in harvesting; for corn, when hastily ripened, scorched up by the sun, and full in grain, soon takes a stain, is damaged by wet, and easily sheds at every blast of wind. The prudent husbandman should, therefore, in such cases, employ the greater number of reapers; for he cannot desire more than that his corn be perfectly ripe, and of a good colour; for which reason, the less it then lies abroad in grip or sheaf, the better it will be. Cutting it high up, so as to avoid the intermixed grass as much as possible, by which means it is the sooner fit for carting, has been found very serviceable on these occasions. And Mr. Lisle is of opinion, that, especially in hilly countries, corn can never be better housed, if thorough ripe, hard, and not weedy, than by gripping and carting as fast as it is cut down; because the dampness which it takes by lying on the ground all night, is not easily removed.

It is constantly most advisable to turn the grips of wheat, which are left out, very early after they have been cut down, in order to get them dry as soon as possible. By this means, they are kept the longer from sprouting in the ear, in case of rain; for, if dripping weather, or driving mist, should ensue, and continue for any time after they have been already loaded with wet, all the art of man cannot prevent their growing; nay, even independent of other accidents, the bare weight of the ears will sink the grips of wheat to the ground, though they have been laid ever so light and hollow; and they will certainly be injured thereby, if suffered to lie long out in wet weather.

A principle, somewhat similar to this, seems to be the reason, why the farmers in Leicestershire and Northamptonshire, in particular where the land is rich, deep, lies flat, and is much enclosed, leave a very high wheat-stubble; upon which the grips are supported, lie the hollower from the ground, and consequently are the easier dried by the sun and wind; for it is to be observed, that the richer the soil is, the sooner the grips will grow after they have taken wet, if they be upon the naked ground; much sooner than they would in the same case in a hilly county, where the land is poor.

The forwarder the harvest is, and the warmer the season, the longer the corn may safely lie in the field, either in grips or sheaves; for this exposure to the air after it is cut down, as has been already observed, mellows it, and makes it thresh better and look finer. Thus, when the wheat-harvest takes place by the middle, or at least before the latter end of July, of which we have had instances, there can be little danger in letting the wheat lie abroad four or five days, or a week, if it be not over ripe when cut, even though a rainy day or two should come; for, at that time of the year, the sun is so hot, the days are so long, the grass so short, and the dews generally so little, that the corn soon dries, even after a hard shower; whereas in the middle, and still more towards the latter end of August, the rainy season frequently begins, the dewy nights grow so long, the grass is so rough, and the sun's drying power so much abated, that, if wet weather comes on then, the corn will be much more apt to grow.

And a caution, which Mr. Lisle recommends as particularly important in hilly countries, is, not to bind the grips of wheat up into sheaves too early in the day; because, in such a situation, the grips take so great a damp by having lain on the ground, that, though the straw and chaffy ears may seem to be dry when the dew is first gone off, and after the

sun may have shone an hour or two upon them, yet there will remain an inward dampness in the corn, and within the straw, which, if laid up in that condition, will come damp from the rick or barn at threshing time. The afternoon is, therefore, certainly best for gripping and binding into sheaves in such countries: but so that this work may be finished before the day is over. The bands should, however, be laid in the morning, that they may not crack: for the straw will not twist after the sun is up, but will be brittle, breaking off below the ears. The turning of three or four of the stubble or bottom ends of the straw to the ears of the band, helps greatly to add to the strength and toughness of the bands. The bands for binding up the sheaves should only be spread in fair weather, as they will otherwise be liable to grow by being pressed to the damp ground; and, though they should always be made while the morning dew is upon them, the sheaves ought not, by any means, to be bound up wet; as, if they are, they will certainly grow mouldy.

But though these modes may be useful, in some cases, with some sorts of corn, they should not be much used for wheat; as it has been found, that the less that grain is exposed to wet the better. Thus it has been observed, that "the practice of covering the shocks of wheat-sheaves is in use between Sandwich and Dover with cloths and mats; but that mats are more commonly used, and that the practice is found to improve the sample of wheat, so that the Dover bakers give a clear preference to corn thus treated. The mats cost 7*d.* each."

Farmers, it is observed, do not always attend sufficiently to the binding up of their sheaves; but suffer the reapers, for dispatch, to tie the bands just underneath the ears, instead of binding them at the other end; the consequence of which is, that they will hardly ever hold together to be flung into the cart at harvest, and will certainly be in greater danger of falling to pieces before they are threshed. If slight rain is foreseen in harvest time, it is best to bind the grips up into sheaves as fast as they are made, as small showers will wet the single grips so much, that they cannot be bound up. The sheaves, being bound, will soon dry after such wet. But, if hard rain is present, the best way is not to bind up the grain that may be cut into sheaves; because they will then be wet to the bands, and must all be opened again. In a wet harvest, small sheaves are best; because thin at top, and falling close, the rain does not sink down into the middle of them, and so go through into the bands, as it is apt to do in great sheaves, which lie broader, and take a large compass. Small sheaves are also best when many weeds are intermixed with the corn, because the air, wind, and sun, have then a greater power to dry them, than they could have if the sheaves were large.

It has been the opinion of some good farmers, that, if the weather be likely to continue fair, it is best to lay the sheaves, the night after the wheat is cut, one by one, flat on the ground, in order to make the straw lie the closer together, and their ears stand the stiffer and more upright; by which means they will be less apt to open at the top, and rain will have the less power to penetrate, than when laid in shocks. And "Mr. Marshall, in his Minutes of Agriculture, recommends the tying of sheaves but loosely, and not too large; but the extreme must be guarded against; for, if they be tied too loosely, there is danger of their slipping wholly out of their bands, besides their being difficult to load, and worse to stack. He recommends, also, that they be set up in such a manner, as but just to touch each other at the buts and ears, leaving a space of a foot and a half between each sheaf at the band place, and that the ears of the bands be turned inward. He observes, in general, that the small loose-tied sheaves will dry soon, while the large tight-tied ones of the same shock will grow; and that the ears of the bands are the first that will grow; and that those shocks, which stand free and open, far better than those of which the sheaves stand huddled together in a close lump, through which neither air nor sun can penetrate. Instead of tying the band at the foot of the butts, he recommends the tying them loosely about the same distance from the tips, and spreading the buts, setting the sheaves up singly in resemblance of sugar-loaves, leaving the insides totally hollow: this will enable them to dry very soon; and then shifting the bands the next day back again to the common banding-places, and opening the ears, they will soon be perfectly dry."

Where reapers cannot be got but with difficulty, and where farms are very extensive, and the crop of various kinds, a longer time is required to complete the labours of harvest, than in other cases. The experience of bad harvests should teach farmers to sow their grain earlier, and to exert every nerve at that critical season to collect their corns, whenever they will keep; not to neglect an opportunity of gathering a little, unless much be ready. In no case to reap, when they ought to be leading in or housing their grain; and not for a moment to lose sight of the principal operation, which crown the labours of the whole year.

In most of the southern counties of England, the crops of oats and barley, as well as those of peas and beans, are mowed with the scythe, and either repeatedly turned over in the swath, or made up into cocks, where they remain till ready for being carried to the barn or stack-yard. When that is the case, the waggons are set to work, and all hands that can be spared are employed in raking the grounds. In a word, those, who are acquainted with the usual manner in which the operations of hay-harvest are carried on, must have a very correct idea of this method of harvesting crops of grain. Mowing and harvesting grain, in swath or in cocks, if a practice that cannot in any climate or situation be considered beneficial; can only, it is supposed, by Mr. Donaldson, be deemed so where the harvests commence at an early period, and where the climate is remarkably mild, favourable, and steady. That being the case, there is no probability that it will ever be generally established in this kingdom.

It is conceived, that the advantages resulting from harvesting crops of barley, oats, &c. in sheaf, compared to the practice stated above, are both great and numerous. They are concisely enumerated by Mr. Marshall, in his Rural Economy of Yorkshire, who, although accustomed to the method of harvesting in swath, seems sensible of the superiority of the other. The comparative advantages of harvesting barley and oats in sheaf are, says he, numerous. The waste throughout is less; the corn, especially in gaits, is at once got out of the way of the weather; the labour of carrying, housing, or stacking, is much lessened; much barn-room is saved; the labour of threshing is less; the straw, if the harvest proves wet, make much better fodder; and, under this circumstance, the corn preserves its colour in sheaf incomparably better than it does in swath. And, after stating the apparent inconveniency of harvesting corn in sheaf to consist in the increase of labour at the outset, he concludes that, upon the whole, the quantity of men's labour is diminished, not increased, by the practice of harvesting in sheaf. If to this be added the ease and expedition in the business of carrying (the most important business of harvest, and that which requires the quickest dispatch), we may fairly conclude, that, by harvesting in sheaf, the labour, the anxiety, and the hazard of harvest, are lessened, while the quantity, and consequently the value, of the produce is increased.

It is added by Mr. Donaldson, that had Mr. Marshall, when he wrote, been as well acquainted with the great benefits derived from using threshing-mills as many Scotch farmers now are, and had he also known the almost impossibility of threshing clean by these machines, unless when the corn is spread evenly on the board, and taken regularly by the feeders, he would have stated this as one great reason, why the crops of oats and barley should be harvested in sheaf.

In several parts, and particularly in Yorkshire, and some adjoining districts, it is usual to mow crops of oats, barley, beans, &c. with the scythe, and afterwards to bind them into sheaves, and set them in stooks, in the manner described when treating of one of the modes commonly practised in harvesting wheat. When it is intended to harvest corn in swath, or in cocks, the ordinary method is to mow outward, that is, from the standing corn, in the way in which grass is mown; but, when it is proposed to bind up the crop into sheaves, it is mown inwards, or to the standing corn. By this means, and by placing what is called a *cradle* over the scythe, or by fixing twigs of willow formed into a bow on the lower end of the scythe-shaft, the corn is made to fall easily and regularly off the scythe, and to rest against the standing corn in a leaning posture. A woman and a boy generally follow every mower. The boy is for the most part employed in making bands; but occasionally, also, in binding sheaves. The woman, with a long-toothed wooden rake, with a short shaft or handle, gathers the mown corn into parcels, about the size of a sheaf, and, with no less dexterity than quickness, lays it regularly into the band, without ever stooping or touching it with her hands. But, in some places, this is more conveniently effected by a sort of fork; which is constructed with two prongs below, somewhat in the manner of the common hay-fork; to which are added, at the upper part, two upright prongs, by means of which the grain is removed from the swath, and collected into sheaves, the lower prongs raising it up, while the upper ones prevent its falling backwards, and determine the quantity which is proper for the sheaf. It is supposed that, by this simple contrivance, the grain may be gathered more regularly and much more expeditiously into sheaves, than by mere hand-labour.

When the mower has got to the end of the field, he begins to bind, and set the sheaves into stooks, which he continues to do during the whole of his progress towards the end of the swath where he began mowing. The woman is in the mean time employed in raking the stubble, which, on land that has been properly harrowed and rolled, is easily done, and so effectually, that scarce a stalk is lost. It is remarked, however, that several variations from any particular mode are discernable in common practice.

It is supposed, that this method of harvesting oats, barley, &c. may, for many reasons, be deemed superior to that of reaping; and, on that account, merits more than ordinary consideration from those who are hitherto strangers to the practice, and who are not so much wedded to ancient customs, as to disregard every means of improvement, because not generally adopted in the districts where they reside. The scarcity of labourers, and the rapid advance in the rates of harvest wages, are severely felt, and loudly complained of. Every method, therefore, whereby the number can with propriety be reduced, and by which also various descriptions of labourers, as men, women, boys, and girls, can be introduced with advantage into the harvest-field, must tend to obviate the less inconvenience and additional expense, to which farmers are subjected, in consequence of the scarcity of hands, which, at these seasons, is but too often experienced. Without the aid derived during the harvest months from the poor, neglected peasantry of the mountains of Wales, and the Highlands of Scotland, the crops, in many of the more fertile parts of the kingdom, could not, it is asserted, by the present generally established method of harvesting, be cut down and gathered in without abstracting a great number of hands from the various manufactures of the country, and at such rates of wages, as would almost amount to a prohibition against the cultivation of grain.

From examining with great attention the method of harvesting adopted in Yorkshire, the author is perfectly satisfied in his own mind, that it is, in every point of view, preferable, as a general mode, to any other adopted in the island.

It ought, therefore, in his opinion, to be introduced into the north and west of England, and into every part of Scotland; more especially wherever improved cultivation and numerous and extensive manufactures have been established.

In respect to the price or rates of harvest labour, they are so various in different parts of the kingdoms, that it would be difficult, or rather impossible, to ascertain the medium; but this is of little importance. It may be more useful to remark, that a man, accustomed to use the scythe, will go over as much ground in a day as four reapers are able to do. The expense, by using the scythe instead of the sickle, would therefore be lessened; the number of hands reduced; and several descriptions of persons, different from those at present employed, might be rendered serviceable; and, of course, less difficulty would occur in procuring the requisite number. The work, at the same time, would be as completely, and certainly more expeditiously performed; while a greater quantity of straw, an article always necessary, and often valuable, would be annually procured.

But although oats, barley, beans, &c. are crops sometimes mown with the scythe; yet, in the greatest part of the island, they are, it is observed, reaped with the sickle. In some parts of England, the crops are, for the most part, reaped by women; but, in Scotland, the number of men and women employed is nearly equal. In general, the ploughmen are no further engaged in the harvest work, than in bringing home the crop to the stack-yard. In some particular districts, however, especially in those north of the Grampian mountains, every operation of ploughing, harrowing, &c. is suspended; and the ploughmen, he says, bear a share in the labours of the field. There is nothing, in regard to the method of reaping corn, that appears worthy of particular remark. The crop is generally cut within a few inches of the ground. Two, and sometimes three, reapers put their handfuls, when reaped, into the same band, which is made by one of the reapers. One man commonly binds and stouks after five reapers; but, when these are expert at using the sickle, it is hard labour for the binder. Hooding or capping the stooks is, in some counties, seldom attended to: in others, again, it is never omitted, even in the most favourable seasons.

In late rainy harvests, the preservation of the crop becomes sometimes a difficult, and always an arduous, task. Besides the ordinary methods of stooking and hooding, others are therefore often adopted, as gaiting and hutting; but this is only done when, from the precarious state of the weather, the crop, without extraordinary exertions, would be in danger of being materially injured. Gaiting corn is a practice very common in the counties of York, Durham, Northumberland, Aberdeen, Banff, &c.; and is a method well calculated for harvesting corn, in late bad seasons, with safety and expedition. It is thus performed: the sheaf, in place of being bound tight and near the middle, which is the usual method, is tied slackly, and the band moved up till it reach some of the ears. The binder then sets the sheaf with some force on its bottom, so as to give it a base to stand upon.

When corn is gaited by a person experienced in the business, he always thrusts his hand down through the middle of the sheaf, after it is set on end, and spreads out the bottoms, leaving the middle hollow, and taking care always to form a small opening towards the south; by which means, both the air and the rays of the sun have the greatest possible influence in preserving the crop, and rendering it fit for being stacked. When corns are cut wet, which is frequently the case towards the close of a late harvest, this is probably the best means that can possibly be devised for averting the impending evil. The method of endeavouring to save corn in bad harvests, by hutting it in the field, is also often practised in the north and west of Scotland, and with very great success; especially when put in a tolerable state of dryness. The huts are formed on the field as soon as the corns are reaped, and bound up into sheaves. They are only made of such a size, that a man can build them standing on the ground, and usually contain from twelve to twenty stooks, according to the bulk of the straw. When these huts are properly formed, and a sheaf or two spread carefully over the top, so as to answer the purpose of an umbrella, scarcely any weather, however bad, or of however long continuance, will materially affect the grain. The writer had occasion to see one of these huts taken down, which had stood for a considerable period (five or six weeks), under the most severe rains that happened during any harvest since the year 1782; and, except a few of the top sheaves, the whole was in a state of preservation truly surprising. This was the more remarkable, as the crops in some adjacent fields, where that precaution had not been adopted, although carefully stooked and hooded, were grown and matted together in such a manner, that every stook formed a connected mass, not only of vegetable, but of vegetating substances.

The loss, inconvenience, irritation, and anxiety, to which farmers are subject during a tedious unfavourable harvest, are real evils, and can, at best, be but alleviated even by the greatest attention and exertion.

When the harvests are late, the weather unfavourable, and the approach of winter apprehended, the hutting corn in the field may be safely recommended as a beneficial practice. When the weather continues long rainy, and there is a risk of the grain springing in the ear, or that a heavy fall of snow will take place (for this writer has repeatedly seen happen before the close of harvest), the best method is to reap and gait with all expedition.

In several of the midland, and more particularly in the south-east counties, the barns are in general of a large size; as, in this case, it is usual to house all, or at least as much as possible, of the wheat crop, immediately from the field. But, in other parts of the kingdom, wheat, like other crops, is built into stacks in a yard, allotted for the purpose, adjoining to the barns; into which it is put only when the farmers find it convenient or necessary to have it threshed. The crops of oats, barley, beans, and peas, are almost every where built in the stack-yards in different forms, according to the custom of the place. In regard to housing the crops from the

fields, it can be done with propriety only when they are thoroughly dry; and is, therefore, a method which, were it adopted to any extent in several districts where the climate is particularly precarious, could not fail to be attended with bad consequences. Building the crops in stacks is, without doubt, the best mode for preserving both the corn and straw. But it should be remarked, that, in order to avoid loss by vermin, and to prevent the bottoms of the stacks from spoiling, or becoming musty, by being placed on damp ground, they ought always to be built on pillars, either of stone or wood. When that is done, and the caps of the pillars are of such dimensions, and so placed, as to prevent rats or mice from ascending, corn, well built and properly thatched, will keep in good condition for a considerable length of time.

In the carrying or conveying the crops from the fields, though there is a great difference in the size and shape of the waggons, carts, &c. used in performing the work, as well as in the strength of the cattle by which they are drawn; yet, in the general mode of conducting the business, there is little variation. The corns, in whatever manner harvested, are put on the carriages by persons stationed in the fields for the purpose, and, being drawn to the yard, are forked on the stack by the carter.

It has been advised by the author of the Farmer's Calendar, that "where there are teams enough, carting the wheat-crops should employ three waggons: one loading in the field, one unloading, and one upon the road going backwards and forwards: five or six horses are sufficient for them, and two men to pitch, two to load, one to drive, and two to unload; in all seven: which make good dispatch." But that "the use of one-horse carts is very superior, whatever the number of horses" may be that are employed. It is added, that "let each be in a well-formed cart, and much more ground will be cleared than the waggons can effect."

When the crops have been harvested in the swath, several persons are employed in stacking, that operation being conducted in the same manner as when hay is stacked; but, when the crop is bound up in sheaves, one man only is employed in forming the stack, unless it be of more than ordinary dimensions; in which case, the assistance of a boy is commonly necessary, who receives the sheaves from the carter, and hands them to the person who builds the stack. In performing this business, it is necessary to attend to different circumstances, such as the form, the mode of building, trimming, and thatching; as, upon each, advantages depend in the preservation of the grain. See *Stacking of Grain.*

Harvest-*Beef*, a term provincially applied to the meat used by harvest-men, whether beef or mutton.

Harvest-*Home*, a sort of feast given by the farmer, after the finishing of the harvest, to the labourers and others that have assisted in cutting and securing the crops. This custom is but little prevalent at present. The term is sometimes also applied to the song made use of on the occasion.

Harvest-*Labour*, a term signifying field-work during harvest; such as reaping, cutting, and securing corn-crops.

Harvest-*Men*, such labourers as are employed by the farmer for the purpose of performing harvest-work. In their engagements with these men, farmers have recourse to different methods, according to circumstances and seasons; but, at present, perhaps, the most economical mode is, to let them the work by the acre, to perform every thing in respect to it. Some, however, hire them by the month, and keep them in the house, by which they are constantly at hand; but it is expensive.

The method of victualling harvesting-men in Gloucester, according to Mr. Marshall, is singularly judicious. They have no regular dinner. Their breakfast is cold meat. Their refreshment in the field, bread and cheese, with six or eight quarts of beverage. At night, when they return home, a hot supper, and, after it, each man a quart of strong beer, in order to alleviate the fatigues of the day which is past; and, by sending him to bed in spirits and good humour, to prepare him for the morrow's toil.

There is, says he, more than one advantage arises from this custom. All work within doors in the middle of the day is got rid of; and the advantage of continuing the work of the field without a break, through the prime part of it, is obvious, and is highly estimated by those, who know the value of it from experience.

The hours of work are long, from dawn to dusk; especially when dispatch is more requisite. The quantity of work done is, he observes, above par; namely, twenty or thirty loads of corn with one set of men.

HASK, in *farriery*, a husky kind of cough in horses and other animals.

HATCHET, a small axe.

HATCHING, the process of incubation in oviparous animals. See *Poultry.*

HATTOCK, a *shock* of corn, consisting of six, eight, ten, or twelve sheaves, so set together, that they may be protected from the effects of the weather. This is generally accomplished by two of the sheaves, which are termed *hooders*, being opened in the middle, and clapped over the others, which are placed together with the grain ends upwards for the purpose, when they are as it were thatched. This method is common where the grain is reaped by the sickle.

HAVER, a name given to oats in some parts of the kingdom.

Haver *Meal*, such as is made from oats, by grinding and sifting through a proper sieve for the purpose.

HAUGH, a term used in the northern parts of the kingdom to signify the low flat lying tracts of land on the sides of rivers, and which are often liable to be covered with water. Also the same with *haw.*

Haugh *Land*, a term applied, in some places, especially in Scotland, to that description of land, which is formed by a sort of deposit from water, and which is generally situated along the sides of rivers,

as just stated. Lands of this nature are proper for the growth of most sorts of grain-crops, as well as those of grass, when not liable to be overflowed by water. It is observed in the Farmer's Magazine, in speaking of the improvement of this description of land, that, "in Scotland, lands of this kind are in too many instances left either entirely, or in a great measure, to the mercy of the waters that run through them. In the low parts of the kingdom, much loss has been occasioned by this neglect; and many extensive tracts on the banks of rivers and streams, which might, with small expense or trouble, have been rendered very valuable, are, at present, in a great measure useless to the community: and that, in the hilly and upland parts, the loss is still greater; as, in such situations, their best soil, and that on which their principal dependence for corn and hay is placed, is their haugh lands. Throughout the whole of these districts, there are hollows, between the different ranges of hills and high lands, through which rivers or rivulets take their course upon the banks, of which there is generally an extent of soil of good quality, consisting, principally, of the finest particles of earth that have been washed down by the rains from the higher grounds, and which, by the accumulation of ages, have formed a soil of such depth and quality, as to be fit for the production of the most valuable crops. In their present state, however, their value, the writer says, is trifling, compared to what it might be under different management; for, owing to the stagnation of water, in some places, a considerable part is either covered with flags and rushes, or converted into morasses; and the remainder, owing to the frequent inundations to which it is exposed, partly from the overflowings of the rivers or rivulets, and partly to the torrents which descend from the hills during heavy falls of rain, can never be cultivated with safety or advantage for grain; even the small spots that are reserved for hay, are far from yielding certain or profitable returns, the whole crop being, in many instances, either much damaged, or entirely carried off by the floods in a very few hours: in that way, the cultivation of considerable tracts of the best soils in the kingdom, have been abandoned; and the principal advantages at present derived from them, consist, in some places, of bad pasture; and, in others, of a quantity of coarse rushy hay of little utility."

It is added, that "the rivers or streams that run through these haugh lands, being left entirely to themselves, and having no proper boundary, generally take a serpentine course, and, by wandering through the valley in every direction, not only occupy three, four, or five times the space of ground they ought to do; but, by their frequent windings, the declivity is so much lessened, that the water runs very slow, indeed almost stagnates at every turn; and when swelled by any sudden fall of rain, the banks are not only overflowed, but if, by accident, the adjoining lands are under tillage, or any part of the surface broken, the water frequently forsakes its old course, makes a new channel for itself, and in that way breaks, cuts up, and destroys, the best of the soil upon its banks. Those, who have lived upon the banks either of a considerable river, or even of a small stream, especially in the neighbourhood of highlands, must have observed many instances of the overflows and consequent devastation here mentioned. These evils, as already noticed, arise, it is observed, partly from the serpentine course of the water, and partly from the torrents that pour from the hills; the first, by lessening the declivity, retards the course of the water, and occasions an overflow at every turn; the last, by having no distinct channel through which the water might be conducted to the bed of the river, spreads over and inundates the whole of the lower grounds. The above will, it is asserted, be found a pretty just picture of that description of property throughout the island, over the greatest part of which the water has been allowed to wander at large for ages, without a single attempt to remedy the evil, by confining it within proper channels. Though the intelligent reader will readily understand the cause of water taking a serpentine course, and doing so much mischief in places where no pains are taken to confine and direct it into proper channels, it is presumed, that some explanation of it may not be unacceptable, especially as such explanation will be found connected with the remedy to be afterwards proposed in such cases."

The writer remarks, that "it is well known, that all bodies, whether solid or fluid, when once put in motion, continue to move in a straight line, unless they are stopped or turned out of their course by some obstructing cause. If, in their progress, they meet with a body, whose power of resistance is equal to their weight and velocity combined, they will be rendered stationary; but if the resisting body has only a power to alter, and not entirely to stop their course, they will recede or fall off from that body in an angle, directly corresponding to that in which they approached it; when a current of water, therefore, meets with an obstacle capable of altering its course, it recedes from that obstacle in an angle opposite and equal to that in which it approached it, and continues to follow that new direction, till it meets with another obstructing cause. In that way it continues to traverse the valley, every little obstruction it meets with altering its course, and giving it a new direction. In order to remedy these evils, two things are, it is thought, necessary; first, to give the water a proper direction, and, as far as possible, confine it within its own bed; secondly, to interrupt the torrents that descend from the hills during heavy rains, and conduct them through proper channels to the main stream. To accomplish the former of these purposes, the first step necessary is, to give the river or rivulet as straight a course as possible to the nearest out-fall: in that way, it will enjoy the full benefit of the declivity, and flow on without interruption. The advantage of this practice will be very obvious to every person of observation; for if, in the course of a mile, the fall taken in a straight direction is fifteen feet, if the water is allowed to take a serpentine

course, and make a circuit of three miles, it is plain that two-thirds of the fall will in that way be lost, and, in place of fifteen, will be only five feet per mile of this serpentine course; in many parts of which, it will be nearly a dead level, and the water, in place of running off freely, will stagnate and overflow the adjoining lands. Objections will, it is observed, no doubt be made to the proposed plan of straightening the course of rivers, on account of the expense of digging and forming a bed of depth or breadth sufficient to contain the whole of the water during the floods; and certainly, upon the first view of a river or stream that has never been confined within proper channels, but allowed to traverse the whole of the flat country in its course, any attempt to confine it would, by many, be deemed at once expensive, and a hopeless undertaking. Upon a nearer examination, however, much of the difficulty will, it is supposed, disappear, and the plan will not only be found more practicable, but the expense much less than was at first imagined; for if the new channel is only made deep enough in the middle, with a large and gradual slope on each side, the current (which, by straightening, will be greatly accelerated) will very soon do the rest, and make a sufficient bed for itself; besides, as the mischief above noticed, in most cases, does not arise so much from the quantity of water, as from its stagnation, when that is removed, no accumulation can possibly take place; the whole will run freely and rapidly off, and a much smaller bed will be required to contain it. This will be the case even with pretty large rivers, where due pains are taken; but when it is considered, that the greatest part of the waters that take their course through haugh lands are small streams or rivulets, many of which are either dry or nearly so during the summer months, the success of any attempt to give them a straight course, or confine them within proper channels, will certainly appear much more flattering and reasonable."

Having said this in regard to straightening of rivers or streams, the writer proceeds to the second object, namely, the interrupting the waters which pour from the hills or highlands during heavy rains, and conducting them through proper channels to the main stream. "To do this effectually, several open drains should, he says, be cut along the face of the declivity, with a gentle inclination towards the stream; into which the water, after being collected by these open drains in the face of the hill, may be let through other open drains, at stated distances, running also in a slanting direction towards the bed of the river. In some cases, it will be necessary to have cross-drains communicating with those that run along the declivity: where that is done, the second drain from the top should be deeper and wider than that immediately above it, and so on, increasing the dimensions gradually, in proportion to the quantity of water they are meant to contain, that at the bottom being always wider and deeper than any of those above it. It is necessary to observe, however, that, when the drains running along the declivity are connected with each other by cross-drains, the latter should always be cut in such a direction as not to run in a straight line downwards, but rather obliquely; for, if the water is allowed to descend from the upper drain immediately below it in a straight line, it will act so powerfully against the lower side as to occasion excavation and breaches, through which it will escape, and, in that way, not only render the drain useless, but overflow the ground below it."

The representation contained in *pl.* XXXII. *fig.* 11. may convey some idea of the advantage to be derived from the straightening of rivers, and interrupting the water coming from the high grounds above them:—

"A, A, A, represent a range of hilly ground, B, B, B, B, and H, H, H, an extensive haugh at the bottom. C, C, C, a river or stream running through it. D, D, D, D, open drains or ditches cut in the face of the high ground, and sloping gradually towards the stream. E, E, E, a deep and wide ditch, at the bottom of the declivity, for receiving the water from the sloping drains D, D, D, D. F, F, F, drains for receiving the water from the ditch E, E, E, and conducting it to the main stream. G, G, G, a cut proposed to be made in a straight direction for a bed to the river, in place of the serpentine course. C, C, C, the banks planted with trees. 1, 2, 3, 4, to 17, ridges running parallel to the cut G, G, G.

It is remarked, "that the ground occupied by the proposed cut will not only be much less considerable than the bed serpentine course, but the haugh lands on the banks will admit of being laid into regular fields, which can be laboured with much less trouble than the irregular spots represented on the serpentine banks; with the additional advantage of the whole being completely secured, both against the overflowing of the river, and the waters from the high grounds. It may, perhaps, be imagined by some, that if a ditch of sufficient dimensions is made at E, E, E, it will answer the double purpose of receiving and conducting the waters coming from the hills to the main stream; a mistake that requires little observation to correct. Water, like every other body that is falling from a height, has its velocity encreased as it descends. In cases, therefore, where it is allowed to run to the bottom in a straight direction, before any attempt is made to interrupt it, the force thus acquired will be so great, as to bid defiance to any ditch or other contrivance that can be thought of for receiving it, or checking its further progress; whereas, when received into the drains d,d,d,d,d, and led down in a slanting direction, its force will be found comparatively small, and it may then be conducted to the bottom with great ease. Another very useful purpose will be answered by having the open drains upon the declivity, namely, that of receiving and cutting off many of those springs that break out on the sides and near the bottom of all high-lands, and render many valuable tracts swampy and unfit for cultivation. The expense attending an undertaking of the kind proposed will, when conducted with judgment, be found small, when compared with the advantages arising from it; the soil, as well as the substratum,

of such haughs, consisting for the most part of loose incoherent materials, which admit of being dug or removed with very little trouble or expense."

It is further noticed, that "waters may be confined within their banks, and have a straight direction given them in different ways; first, by stone; secondly, by turf banks. Where stones are plenty, which they are upon the banks of almost every river and stream in Scotland, and in many parts of England, if the bank is properly sloped and faced with them, it will be found completely to resist the encroachment of the water, especially if the stones are well bedded, and the interstices blinded or filled up with sand or clay. Where a new cut is to be made, care should be taken to have it of sufficient width. After marking out the lines intended for the banks, the earth should be dug out, taking it from the middle to the full depth of the intended bed, in such a way as to form a regular and gradual slope to the top of the bank, which should be faced or covered with stones, in the manner above mentioned. The earth and other materials taken out should be employed in filling up the whole bed of the water, which will render the surface uniform, and facilitate its future improvements. It will contribute much to the durability of the banks, if, after the work is finished, a quantity of coarse hay-seeds are sown: these, by vegetating in the interstices between the stones, will very effectually prevent the water from insinuating among them, and bind and give a degree of stability, as well as beauty, to the whole, which it would not otherwise possess.

"But, in cases where the stream is not rapid, and where there is little risk of the banks being washed or hurt during the summer months, facing them with sod will form a good barrier to the water. Where that is done, however, it will be necessary to drive several rows of piles into the bank parallel to the stream, which (if they are sufficiently strong) will add greatly to the strength of the work. In every case, where it is meant to turn a stream into a new course, the most certain way of rendering the work durable will be found to consist in forming the new cut at least a year before the water is let into it: in that way the earth, of which the banks are composed, will be consolidated, and the surface so completely protected by the growth of the sod or seeds sown upon it, that there will be little risk of its being afterwards broken or penetrated by the water."

It is added, that "the advantage of sloping banks as a defence, either against the waters of the ocean or rivers, is well known. It is also known, that the greatest part of the mischief done, either by the sea or rivers, is in situations where the shore presents a perpendicular front to the water, and is at the same time composed of soft incoherent materials; and the higher the shore and deeper the water, the greater the mischief in general is; whereas, when the bank or boundary is a gentle slope, the force of the water, in place of being increased as it rises, which is always the case where the boundary is a perpendicular, is gradually lessened, rising without injury to the top of the bank, and sinking again to its ordinary bed in the same manner. To the above observations it is added, that additional benefits will arise from planting couch-grass, willows, and all other plants that thrive in such situations, upon the banks where new cuts are intended to be made; the root of which will bind and strengthen them in such a way, as to prevent their suffering from the water at any after period: indeed, upon the banks of most rivers, they grow spontaneously, and greatly assist in confining the water, and preventing it from changing its course or bed. See *Embankments*.

HAUGHTY *Weather*, provincially windy or stormy weather.

HAUNCH, in *farriery*, the hip part of an animal. The haunches of a horse are said to be too long, when, standing in the stable, his hind legs are farther back than the proper line, and the top or onset of the tail does not answer in a perpendicular line to the top of the hocks, which is always the case in horses whose haunches are of a just length. It is sometimes written *Hanch*.

There are some horses, which, though they have too long haunches, yet commonly walk well: such are good to climb hills, but are not fit to go down a descent; as they cannot ply their hams, and never gallop slowly, but almost always at full speed.

HAW, a term applied, in some districts, to a close or small field. There are also *hemp-haws*, and *bean-haws*.

Haw, the common name for the fruit of the white-thorn. See *White-thorn*.

Haw, in *farriery*, a term applied, by some, to swellings of a spongy texture, taking place in the inner corners of the eyes of horses, and which is sometimes so large as to cover part of the eye. But Mr. White considers this as a cartilaginous substance, proper to the eyes of horses; and that its appearance over the eyes of a horse, when affected with inflammation, has led to an erroneous opinion, that it is a diseased production, and should be extirpated; and there are directions for that purpose in many of the books of farriery. And Gibson remarks, that "haws grow sometimes in eyes that are not naturally bad, after surfeits and cold, but moon-blind horses indeed are seldom without them; and wherever this symptom appears, that the haws grow large and spongy, and derive a drain of humours upon the eye, the operation becomes necessary, and is performed by taking hold of the membrane with a small hook, and cutting off so much of the caruncle as looks moist and spongy, with part of the membrane and gristle that make a pressure on the eye. When this operation is well performed, it does great service, and often recovers horses that are not subject to cataracts. The operation is easy, and what almost every farrier pretends to; but the farriers are apt to cut off too much of this substance, and by that means weaken the eye."

Haw-*Thorn*, the name of the thorn usually employed in the making of hedge-fences. See *Fence*.

HAY, a term commonly applied to a clipped hedge in some districts.

HAY, a general name applied to any kind of grass, which is cut and dried, in order to be preserved for the food of cattle, horses, or other animals.

There are different sorts of hay, according to the nature of the land from which they are produced, and the kinds of grasses from which they are formed. Thus we have *meadow-hay*, *upland* and *orchard-hay*; as well as *clover-hay*, and that of other kinds of artificial grasses.

Hay is also of different qualities, according to the nature of the grass, and the land from which it is produced; and, of course, applicable to different purposes in the feeding of animals. That which comes from the upland-meadows, or which, in some districts, is termed ley-hay, and that which arises from the cultivation of artificial grasses, such as the different kinds of clover, rye-grass, sainfoin, lucern, and other similar plants, is the most proper for the feeding of horses, and labouring cattle in general, as affording a more durable and permanent support, and giving them better wind; while the low-meadow, marsh, and orchard hays, are, from their more soft qualities, better adapted to the feeding of cows, and other sorts of neat-cattle, and such horses as are not employed in much hard labour.

Rouen, or after-grass hay, which is made in favourable seasons in some districts, as being still more soft, is the most suitable for the feeding of milch-cows and sheep. In the lamb-suckling districts, the greenest, and that which retains the most succulence, is commonly employed for the suckling ewes.

Hay is sold in various ways, according to the peculiar custom of the place: as, by the stone, yard, and load. The last is the custom of the London markets; in which the hay is usually bound up into trusses, weighing fifty-six pounds, thirty-six of which constitute the load; or about eighteen hundred weight, when the hay comes from the stack; but if sold from the field, or soon after being put into the stack, twenty hundred weight is generally accounted a load.

HAY-*Maker*, a person employed in the business of making grass into hay. In order to perform this sort of field-work with propriety, it is necessary to be well acquainted with the different operations and processes that are to be practised; such as those of spreading, raking, tedding, cocking, &c. Where persons unacquainted with these are employed, the farmer must frequently suffer considerably from such operations being incompletely performed.

It is observed by the writer of the Middlesex Report, that when the grass is nearly fit for mowing, farmers, in that district, endeavour to select the best mowers, in number proportioned to the quantity of his grass, and the length of time it would be advisable to have it in hand; which having done, he lets it out, as piece-work, or to be mown by the acre: each man mows from an acre and an half to an acre and three-quarters per day: some there are, who do two acres per day, during the whole season. That the mowers usually begin their work at three, four, or five o'clock in the morning, and continue to labour till seven or eight at night; resting an hour or two in the middle of the day. See *Mowing*.

And that, about the same time, they provide five hay-makers (men and women*) to each mower. These last are paid by the day, the men attending from six till six, but the women only from eight till six: for an extra dispatch, they receive a proportionate allowance.

Every hay-maker is expected to come provided with a fork and a rake of his own; but, when the grass is ready, and labourers scarce, the farmer is frequently obliged to provide both; but for the most part only the rake. And every part of the operation is carried on with forks, except clearing the ground, which is done with rakes; and loading the carts, which is done by hand.

HAY-*Making*, the art of converting such grass as has been cut down into hay. In the making of hay, it will constantly be necessary to attend to the nature of the grass, the state of the season, and the situation of the ground. Where the grass is of the more dry kind, and the situation high and open, in all seasons, much less time will be requisite for the business, than where the contrary is the case.

This is an article of food, which is not only of much importance to the farmer as being a principal product of land, but as constituting the chief fodder of most sorts of domestic animals, and upon which their health and condition in a great measure depends. Under such circumstances, it might have been supposed, that experiments would have been made, and a suitable degree of attention paid, to form a regular system of management. But it is much to be regretted, that in many parts of the island, no such attention has been bestowed; and that the treatment, especially in many of the more northern parts of the island, is slovenly in the extreme, and very ill calculated to secure and preserve, in the highest degree of perfection, that flavour, and those nourishing qualities, without which, neither hay, nor indeed any description of herbage, can be valuable for the purpose it is intended.

It is observed in an useful paper in the first volume of the Farmer's Magazine, that "the first consideration in the treatment of hay is, the period at which it should be cut, and the weather most proper for that operation." It is added, that as "the time most proper for cutting the different kinds of grain, together with every step of the after-management, are points well understood, and for the most part strictly observed; every farmer being sensible that any neglect of, or deviation from, these rules will, by impairing the quality both of the grain and straw, be productive of much trouble and loss to himself; it is somewhat surprising, that the same kind of reasoning should not have been applied to the management of hay; as any diminution of its value, arising from improper treatment, must be equally prejudi-

* Including loaders, pitchers, stackers, and all others.

-cial both to the grower and consumer of that article, as to the grower and consumer of grain."

It is stated, that "the practice of many farmers in North Britain is, to allow their hay, not only to attain its ultimate growth, but even to make some progress towards decay, before it is cut: To obtain a bulky crop being their chief object, every other consideration is disregarded; and neither the period of growth at which the cutting ought to commence, the weather most proper for that operation, nor indeed any step of the after-management, are regulated by first rules. In place of cutting the crop during dry weather, and when it is free from every other but its own natural moisture, it is very often cut in a wet state, and on that account must remain in the swath a considerable time before it is fit for being put into cocks; during which, it requires to be frequently turned and exposed to the sun and atmosphere, for the purpose of drying it: In that way, a considerable proportion of its natural juices are dissipated; and, by the time it is dry enough for putting into the stack, it has lost not only its flavour, but a great part of its most valuable properties; an evil that is farther increased, if much rain happen to fall either immediately after the cutting, or at any period before it is put into cocks: In that case, a still greater loss of its nourishing properties, and a consequent diminution of its value, must happen." And "the consequences of this management are felt," it is asserted, "in a variety of shapes, in every district where it prevails. In the lower districts, the mischief is comparatively small, owing to the mildness of the winters, the great quantity of rich foggage every where to be met with, and the abundance of corn-straw, and other wholesome articles of food, with which these parts abound. In the hilly and upland districts, however, the case is very different; and the loss arising from the neglect and mismanagement of their hay is great, almost beyond calculation. In these elevated regions, the winters are, for the most part, of uncommon length and severity; little straw is produced; sown grasses, turnips, and potatoes, are equally scarce: In that way, the chief dependence of the farmer, for winter-food to his stock, falls upon the hay, which, when the quality is bad, and other articles scarce, induces debility and disease to such a degree, that a great part of the stock either die, or are reduced to a state of extreme weakness during the winter; and when the spring arrives, the green food has such an effect upon the bowels of those who have survived, that many of them die also." It is further remarked, that "the greatest part of the hay grown in these parts is the produce of the wet swampy grounds, and the plants, of which it consists, are of a nature that requires much judgment and attention to cure, in such a manner, as to unite every advantage that might be expected from their use." It is added, that with respect to the period most proper for cutting hay, "experience proves, that the greatest perfection of the herbage is met with, either immediately before it comes into flower, or as soon as the first flowers blow: At that period, it is in no shape exhausted, either by blowing a multitude of flowers, or forming seeds, and contains all the useful qualities of which its nature is capable: After that period, it daily diminishes in value, becomes tough, sapless, and unpalatable, and is not chewed without considerable difficulty. This rule applies to every species of herbage that is meant to be dried for winter food; but to coarse hay, the produce of wet or marshy grounds, it is strongly applicable; for most of the plants which grow in these situations, when they are in full vigour, are as tender, and contain perhaps as great a proportion of nourishing juices, as any other description of hay; and, when cut at that stage, and properly managed afterwards, form a valuable article of food both for sheep and cattle; but when the cutting is delayed, as indeed it very often is, till an advanced period of the season, when the plants have not only reached their ultimate growth, but begun to decay, this description of herbage becomes at once the coarsest and least nourishing of all food" that can be used in that way.

And it is contended, that "this opinion does not proceed upon theory, but upon the solid ground of experiments carefully made upon many different kinds of herbage, at different periods of their growth, the result of which establishes a fact that cannot be too generally known, viz. that plants of all sorts, if they are cut when in full vigour, and afterwards carefully dried, without any waste of their natural juices, either by bleaching with rain, or exhalation, contain, weight for weight, a quantity of nourishing matter nearly double what they do, when allowed to attain their full growth, and make some progress towards decay." It is therefore concluded, that grass "of all kinds should certainly be cut at the period mentioned, and, if possible, during dry weather."

And this opinion is farther confirmed by the author of the Agricultural Survey of Perthshire in Scotland, who remarks, that, "as the great object in making hay is that of preserving as much of the natural sap as possible, the proper time for cutting is, when the crop of grass has attained its highest degree of perfection; when the plants are in full blow, and before their flowers begin to fade. If cut too green, the hay shrivels and loses much of its bulk; if allowed to stand till the seeds are ripe, the stem becomes hard and wiry, the roots lose much of their natural sap, the aftermath is less abundant, and the principal part of the hay is in danger of crumbling away into short stumps, under the various operations which it must undergo. Better to be too soon than too late; especially if the crop be heavy and in danger of lodging."

And that, with clover, "the best time for cutting it is, when the flowers are all fully blown, and the earliest begin to turn brown. If allowed to stand longer, the roots of the stalks lose their leaves, and become hard and sticky; and the plant is so much exhausted, that it takes a long time before it send up new shoots."

It is obvious, therefore, that, in the converting grass into hay, the great art consists in rendering

it sufficiently dry to prevent its taking on too great a degree of heat in the stack or mow, and at the same time preserving as large a portion of the natural juices of the plants as possible. And that, where this medium can be attained in the most exact manner, the best and most nutritious hay will be produced; but it is a point of great difficulty, and that requires extreme care and attention; the great danger, in fine seasons, being that of not making it sufficiently, while, in those of the contrary kind, it is apt to be made in too high a degree, as is fully shown by the inconveniences frequently sustained from the heating of the stacks in the former cases, while, in the latter, it is seldom or ever experienced.

The able writer of the Middlesex Survey has thrown out an useful hint on this subject, which is, that, in the making of hay, "some attention should be paid to the quality of the soil, and the kind of herbage growing upon it." And that "the hard benty hay of a poor soil, as it is in little or no danger of heating too much in the stack, it should, therefore, be put very early together, in order to promote a considerable sweating, as the only means of imparting a flavour to it, which will make it agreeable to horses and lean cattle, as it will be nearly unfit for every other sort of stock. It is the succulent herbage of rich land, or land highly manured, that is most likely to generate too great a degree of heat; of course, grass from such land should have more time allowed in making it into hay. In moderately hot seasons, the proper point of drying may be easily judged of; but when they are very hot and scorching, it is easy to be mistaken; as, in such weather, the grass becomes crisp, rustles, and handles like hay, before the moisture or sap is sufficiently dissipated for it to be in a state fit to be laid up in large stacks. If that, however, be done when it is thus insufficiently made, it mostly heats too much, becoming mow-burnt in some cases." And that another point, which, though often difficult to be executed, is of much consequence, is that of "carrying the whole of the hay just at the moment it is sufficiently made; which is necessary, in order to its yielding the greatest possible weight, and preserving its best quality; as every minute after that precise time it continues to lose, both in weight and in its nutritious properties, by evaporation," as the smell sufficiently proves. "Even the difference of an hour, in a very hot drying day, is supposed to occasion a loss of 15 or 20 per cent. on the hay, by its being carried beyond the point of perfection, and frequently even a greater loss is sustained."

The author of the Survey of the above County states, that "this branch of the rural art has, by the farmers of that district, been brought to a degree of perfection altogether unequalled by any other part of the kingdom. The neat husbandry, and superior skill and management, that are so much, and justly, admired in the *arable* farmers of the best cultivated districts, may, with equal justice and propriety, be said to belong, in a very eminent degree, to the hay-farmers of Middlesex: for, by them, may very fairly be claimed the merit of having reduced the art of making good hay to a regular system; which, after having stood the test of long practice and experience, is found to be attended with the most desirable success. Even in the most unfavourable weather, the hay, made according to the Middlesex manner, is, he says, superior to that made by any other method, under similar circumstances. It is to be regretted, that this very excellent practice has not yet, except in a very few instances, travelled beyond the borders of the county. But as it most justly deserves the attention and imitation of farmers in other districts, he shall, for their information, endeavour minutely to describe the method in which the Middlesex farmers make their hay." And, "in order that the subject may be more clearly understood, he shall relate the particular operations of each day, during the whole process, from the moment in which the mower first applies his scythe, to that in which the hay is secured, either in the barn or in the stack." See *Hay-Maker.*

"First day.—All the grass mown before nine o'clock in the morning, is tedded (or spread), and great care taken to shake it out of every lump, and to strew it evenly over all the ground. Soon afterwards it is turned, with the same degree of care and attention; and if, from the number of hands, they are able to turn the whole again, they do so, or at least as much of it as they can, till twelve or one o'clock, at which time they dine. The first thing to be done after dinner is, to rake it into what are called single windrows, that is, they all rake in such a manner, as that each person makes a row, which rows are three or four feet apart; and the last operation of this day is to put it into grass-cocks.

"Second day.—The business of this day commences with tedding all the grass that was mown the first day after nine o'clock, and all that was mown this day before nine o'clock. Next, the grass-cocks are to be well shaken out into staddles (or separate plats), of five or six yards diameter. If the crop should be so thin and light as to leave the spaces between these staddles rather large, such spaces must be immediately raked clean, and the rakings mixed with the other hay, in order to its all drying of a uniform colour. The next business is to turn the staddles, and, after that, to turn the grass, that was tedded in the first part of the morning, once or twice, in the manner described for the first day. This should all be done before twelve or one o'clock, so that the whole may lie to dry, while the work-people are at dinner. After dinner, the first thing to be done is, to rake the staddles into double windrows; in doing which, every two persons rake the hay in opposite directions, or towards each other, and by that means form a row between them of double the size of a single windrow. Each of these double windrows are about six or eight feet distant from each other; next, to rake the grass into single windrows; then the double windrows are put into bastard-cocks; and lastly, the single windrows are put into grass-cocks. This completes the work of the second day.

"Third day.—The grass mown and not spread on the second day, and also that mown in the early part of this day, is first to be tedded in the morning: and then the grass-cocks are to be spread into staddles, as before, and the bastard-cocks into staddles of less extent. These lesser staddles, though last spread, are first turned, then those which were in grass-cocks; and next the grass is turned once or twice before twelve or one o'clock, when the people go to dinner as usual. If the weather has proved sunny and fine, the hay, which was last night in bastard-cocks, will this afternoon be in a proper state to be carried*; but if the weather should, on the contrary, have been cool and cloudy, no part of it probably will be fit to carry. In that case, the first thing set about after dinner is, to rake that which was in grass-cocks last night into double windrows; then the grass which was this morning spread from the swaths, into single windrows. After this, the hay which was last night in bastard cocks is made up into full-sized cocks, and care taken to rake the hay up clean, and also to put the rakings upon the top of each cock. Next, the double windrows are put into bastard cocks, and the single windrows into grass-cocks, as on the preceding days.

"Fourth day.—On this day the great cocks, just mentioned, are usually carried before dinner. The other operations of the day are such, and in the same order, as before described, and are continued daily until the hay-harvest is completed."

It is added, that "in the course of hay-making, the grass should, as much as possible, be protected, both day and night, against rain and dew, by cocking. Care should also be taken to proportion the number of hay-makers to that of the mowers, so that there may not be more grass in hand, at one time, than can be managed according to the foregoing process. This proportion is about twenty hay-makers (of which number twelve may be women) to four mowers: the latter are sometimes taken half a day, to assist the former. But in hot, windy, or very dry weather, a greater proportion of hay-makers will be required, than when the weather is cloudy and cool.

"It is particularly necessary to guard against spreading more hay than the number of hands can get into cock the same day, or before rain. In showery and uncertain weather, the grass may sometimes be suffered to lie three, four, or even five, days in swath. But, before it has lain long enough to become yellow (which, if suffered to lie long, would be the case), particular care should be taken to turn the swaths with the heads of the rakes. In this state it will cure so much in about two days, as only to require being tedded a few hours, when the weather is fine, previous to its being put together and carried. In this manner, hay may be made and stacked at a small expense, and of a good colour; but the tops and bottoms of the grass are insufficiently separated by it."

The following method has been advised for making hay in seasons unfavourable to that business: The mode pursued is, the first fine day that comes, to break out what grass is cut, turn it, windrow it, and get it into small cocks: the next fine day, as soon as the ground is dry, to break a few cocks out at a time, and keep them continually moving till they are quite dry; to put three or four of them into one cock. To proceed in this manner till they have been all broke out, and served as above; and, should the weather still continue unfavourable for hay-making, never to venture to break those cocks out again, but to take every opportunity of lightening them up with forks, to let the wind and air draw through them. This plan was pursued in the wet summer 1781, and by that means more good hay was made by the farmer who employed it that year, than any person in the neighbourhood where he lived.

He is thoroughly convinced, that grass, cut full of sap, is not likely to receive much damage from small showers of rain, till it is nearly made into hay; and, on the other hand, grass cut when the bents are quite ripe, is liable to be damaged by every trifling shower that falls. When the grass is thin, or stands to be quite ripe, he has known it only just broke out, raked together, cocked, and the next day put into a rick, without its being over-heated, or any way injured by such hasty proceedings: were they to give such hay much making, he says, it would never settle in the rick.

It has been observed by the author of Modern Agriculture, that, in "districts where the hay season is later, and the weather more changeable, it would often be dangerous to expose the hay so much abroad as in the first of the above processes: a more cautious method should probably be adopted. In such cases, instead of keeping the hay almost constantly spread out and exposed to the atmosphere, as in the preceding method, it may be better to put it into small cocks soon after it has been cut down and become a little made; these should then be frequently turned over, but not spread out, except when the weather is in such a fine state as to insure their being put up again in the same state, without injury from the falling of rain. But this mode is much more slow, though the hay is less exposed to danger in wet weather, than in that; and, when there is much heat, it may be made with little trouble or expense, and without much expenditure of the nutritious juices which it contains."

It has been remarked by Mr. Bucknall, on the Middlesex method of hay-making, that "by the regular method of tedding grass for hay, the hay will be of a more valuable quality, heat more equally in the stack, consequently not so liable to damage, or fire: will be of greater quantity, when cut into trusses, and sell at a better price; for when the grass is suffered to lay a day or two before it is tedded out of the swath, the upper surface is so dried by the sun and winds, and the interior part is not dried, but withered; so that the herbs lose much, both as to quality and quantity, which are very material circumstances, at the price hay now fetches at market.

* It seldom happens, in dry weather, but that it may be carried on the third day.

An instance in point is, he says, the physic-gardeners, who attend to their business, are very careful in the proper and equally drying their herbs, and they find their account in it."

In the Farmer's Magazine it is suggested, that "in place of being suffered to remain in the swath for days, as is commonly done, women, with forks or rakes, should follow the cutters, and spread it in such a manner as to allow the sun and air free access to the whole. If this operation is properly performed, and the weather favourable, the hay that was cut in the morning will be ready to be put into small cocks by mid-day, where it may remain for two or three days; and, at the end of which, if the weather is dry, they may be thrown down early in the morning, and, after being exposed to the sun and atmosphere for a few hours, put up into ricks of at least forty or fifty stones each, where it may remain with perfect safety, till it is convenient to stack it. By such treatment, every valuable quality is preserved, the hay is of a fine green colour, and possesses so agreeable a flavour, that the animals eat it with the greatest relish. Before stacking, some attention will be necessary to render the whole as uniformly dry as possible, especially if much rain has fallen, and the wind continued for any considerable time in one quarter after the hay has been put into ricks: when that is the case, one side will be found damp, while that which is exposed to the wind is perfectly dry: the remedy consists in turning the ricks round, which is done with great ease, by placing six or eight people, at equal distances, round the rick, with directions to thrust their hands as far as they can under the bottom, at the same time grasping a handful of the hay: when the whole are ready, let them lift at once, and move round in the direction intended, till the damp side is opposed to the wind: in that way, ricks of fifty or sixty stones may be turned with ease and expedition, and the whole rendered uniformly dry in a short time."

And as the preserving hay of a proper green colour is a point of some importance, it is necessary, in order to effect it, that the bastard-cocks, previous to their being carried, should be put up in the heat of the day, and remain in that condition till the following morning, when they may be turned and opened, so as to dispel any damp that might induce it to heat in the stack, and in that way injure the colour. It is found that the acquisition of a lightish brown colour in the stack is not injurious to hay; but where it becomes of a *dark* brown, from too much heat, it is said to weaken and relax horses that are fed upon it, by its powerful diuretic quality, consequently of inferior value at the market.

It is stated by Mr. Marshall, in his Rural Economy of Yorkshire, that, "in the best practice of that district, the grass, in fine weather, is tedded after the mowers; or, in showery weather, as soon as a fair opportunity offers. In the evening, unless due confidence can be placed in the weather, it is put into cocklets, provincially "hipples," made in different ways; some being set up hollow with the foot and the head of the rake; others, in the common way, with forks. As the hay has advanced in dryness, the hipples are increased in size.

"Where a fair opportunity offers, and the grass perfectly dry, the hipples are *sundered*; that is, broken out into beds in the usual manner, turned, and again got up into cocklets, of such size as the state of dryness requires. When sufficiently dry, the hay is made into well-sized cocks, namely, about eight or ten to the load.

"When the crop is intended to be stacked on the piece it grew on, the first made part generally stands in these cocks, until the whole, or the principal part of the remainder, be ready for the stack; which, by this means, is never exposed abroad in its first stage, a circumstance, however, which is too commonly suffered by less judicious hay-farmers."

It is supposed by Dr. Darwin, that if the swath of mown grass be turned over only *once* in the day, for three or four successive days, the interior part of it will, in a manner, be dried in the shade; and, if it were spread over the ground for a few hours in the day, the hay would become dry enough for stacking. And, at night, he advises the forming the grass into small cocks, particularly in damp weather, in order to secure it from being injured by the slime and excrements of the very numerous worms that rise to the surface of the ground during moist warm nights. With this view, the cocks are to be made as high in proportion to their base as possible, that a small surface may come in contact with the ground, while a broader top is exposed to the air, and consequently the exhalation of moisture from the hay is promoted; while it is, at the same time, secured from accidental showers. And, in wet weather, he is of opinion that it is best to turn the swaths every day, or every second day, or to form them into small cocks, with the view of sheltering the whole from injury by long continued rains; and also of preventing the parts next the ground, as well as in the middle, from fermenting. But that, when the weather is more favourable, the hay should be made into large cocks, for the more speedy exhalation of moisture by the action of the air; while an incipient fermentation will evolve or discharge a portion of heat, and thus promote the drying of the hay, by increasing the evaporation.

It is advised by Mr. Boswell, that, in making hay from the grass of watered meadows, a *confidential* person follow the mowers, ready to ted the grass immediately after it is cut, in which state it may remain all the first day. And, on the following morning, as soon as the dew is evaporated, it should be repeatedly turned, and formed into small cocks, the trenches and drains being raked clean out. The next day it is again tedded, and raked nearer together; the grass occupying a less space of ground in proportion as it withers: it is afterwards repeatedly turned in the course of the day, and, long before night, formed into *whales* or rows, afterwards into large cocks, and the ground again raked around them. On the succeeding day, those cocks are again spread and turned; when, if they be not sufficiently dry, they are put into still larger cocks;

and, the following day, they may be opened, and the grass, after being turned, carried to the stacks.

The expenses of making hay must of necessity be liable to much fluctuation in different situations and circumstances, according as labourers are more scarce or plentiful, and as the season may be fine or the contrary. In the hay districts, in the county of Middlesex, it was some years ago stated to be as below:

Expenses per Acre.

	£.	s.	d.
Mowing 3*s.* beer 6*d.*	0	3	6
Making and stacking	0	9	6
Pulling the stack, and laying the hay pulled out upon the stack	0	0	6
Horses, harness, and carts	0	2	0
Straw for thatch 3*s.* thatcher and labourer 6*d.*	0	3	6

Total expense per acre in the stack-yard, 19 or 20*s.* At present it is a great deal higher.

It is observed by the writer, that "if the hay be put into barns, the last charge of 3*s.* 6*d.* will not, of course, be incurred; most of the third, and part of the second, will also be saved; so that the whole expense in this case will not exceed 15*s* per acre."

It is obvious, from the nature of most sorts of artificial grasses, that, in making them into hay, the great object should be that of preserving their leaves or foliage as much as possible, as, upon this being done, much of their excellence depends. And of course, in order to effect it in the most perfect manner, a somewhat different practice should be employed to that which is followed with the natural grasses. After the crops have been cut down, they should undergo much less making than with common hay, as too frequent stirring breaks off and displaces the leaves too much; by which great loss is sustained in their being left upon the ground.

It is remarked by Mr. Banister, that "clover begins to form its head for bloom towards the middle of June, and will continue in a growing state till it becomes in full blossom; at which time it is in the highest perfection to mow for hay; but this grass differs in this particular from sainfoin, that when its blossoms are fully expanded, they continue much longer in that state than that grass; so that, if the weather should prove wet and unkindly for the haying, the clovers will wait a fortnight after they become in blossom without sustaining any material injury, either by the shedding of the leaf or bloom; for the same weather which renders it improper to mow this grass, continues it in a growing state, and prevents the blossom from dying away."

"When, says he, the crops of clover are large and heavy, it is necessary that the swaths should be turned over at the making, the stalks of this grass being very replete with juices. This may be done the next day after the mowing, or the second day after, as the weather is more or less favourable, observing that, as the chief virtue of this hay resides in the leaf and blossom, the less they are disturbed, the more valuable will be the fodder: on which account the tedding of this hay abroad, as is practised by some people, cannot fail to be of the greatest injury. From the windrows, it should be made up into grass-cocks, which, having enjoyed the influence of the sun and air for a day or two, may be thrown into large cocks for carting. But, if wet weather prevail during the season for making this hay, it causes an infinite deal of trouble to the farmer; and the clover, from having been frequently shaken abroad, is deprived of its most nutritious particles, namely, the blossom and the leaf."

The author of the Survey of the County of Perth remarks, that, "in making hay of clover and rye-grass, some farmers advise to allow the hay to lie in the swath for two or three days; and after the superfluous moisture and dew are evaporated, in a dry day, either to ted it a little, or turn the swaths, and in the afternoon to make it up into small cocks, suitable to the state of the hay. The only objection to this management is, that the hay on the surface of the swath is apt to be blanched by the weather, the juices exhaled by the sun, and the flavour of the hay lessened. This disadvantage is, in a great measure, only imaginary; because, after the hay has lain a day or two in the cocks, the whole becomes so much alike, that the exposed part can scarcely, if at all, be distinguished from that, which was in the bottom of the swath. The dried part imbibes the juices of the moist, and the moist is kept open and more accessible to the air by means of the dry." But that "the practice of others is, to cut down their hay in a dry day, and in the afternoon of the same day to make up their hay into small cocks, by which means the whole juices are preserved, and the damage of blanching completely obviated. The objections to this mode are, that it occasions unnecessary labour; that, if rain happens to fall, the cocks are so moist, that the hay may spoil before it can be opened out; and that they are so small, if wind blows, they are in danger of being overturned. As a remedy against its being too moist, it is recommended to draw two handfuls of hay to be laid across on the top, by way of a thatching to the cocks; and, in the last case, to press them down a little with the hand, will render them more firm." And that "Mr. Patterson, of Castle-huntly, in the Carse of Gowrie, makes his hay, by employing a person to follow the mowers, who turns the hay over and over, till it be completely *winn.* If the season be favourable, it is put into the tramp-rick in the stack-yard." This is a sort of large cock frequently used in the northern districts. It is stated, that "upon his farm 300 stones, of 22lb. English to each stone, is accounted a good crop from an acre of land; which is not uncommon in that district, and in several other parts of the county. In the year 1786, he had 6000 stones of hay from a field of 13 acres, sown originally among wheat; and for the second crop of the same field, that season he received 2*l.* 13*s.* 4*d.* per acre."

The writer farther remarks, that "one precaution in this sort of hay-making is absolutely necessary, never to make hay up into the first cock, when it is in the least degree wet; otherways it soon

becomes mouldy, by sitting so close together, as to exclude the air." And that, "whether a farmer thinks proper to make up his hay into the first cocks in either of the two ways above-mentioned, or in any other, which he may prefer, when these cocks are to be turned, and two or three of them put into one, according to the condition of the hay, he should not neglect to put the driest part of the old cocks next to the bottom of the new ones; and continue to do so every time the ricks are turned, until the hay be ready for the tramp-rick." He adds, that "it is almost unnecessary to advise a farmer of experience, that in making tramp-ricks, they ought to be secured, by one rope over the top, in the direction of that point from which the most violent winds are expected to blow at that season, or by two transverse ropes, which is the surest way; and that the ropes ought to be so fixed at the ends, as to draw no rain into the hay. The tramp-ricks should also be neatly raked down the sides, and well drawn all round close to the bottom, so that the rain may fall from the sides into the earth; not leaving the hay in a flounce at the skirts, in a slovenly manner, which part of the hay is entirely spoilt, if it remains long in the field. If tramp-ricks are made, where the hay grew, make them always on the crown of the ridge, that the water may run freely off in the furrows: But it is more advisable to carry the hay to the place, where the stack is to be made, than to make the tramp-ricks in the field, because the second crop of that year, and the growth even of the next year, is injured on the spot, where these ricks stand; and besides, all the hay will be at hand, in making the stack, to get it cleverly finished, in case of a change of weather. When hay has stood in the tramp-rick so long, but no longer, than is necessary to keep it from heating, because the surface is often injured by the weather, the stack is frequently made in an oblong form, which is vulgarly called a *sow*."

The writer further states, that "it is computed that a stack of rye-grass hay, which is a year old, weighs, for every cubic yard, ten or eleven stones, of Dutch weight, viz. 17½lb. English, to the stone; clover and rye-grass somewhat less, and clean clover still less." And that "it has been generally understood, but not examined with sufficient accuracy, that four-pence is as good a price for hay weighed from the tramp-rick in August or September, as sixpence at Candlemas or March, i. e. that hay does decrease one-third in weight during that time. An experiment of Mr. Robert Webster, at Mains of Errol, will, he says, throw some light on this matter. He weighed two stacks of hay from the tramp-rick, in August 1793, each consisting of 400 stones of similar hay, from the same field, and at the same time. Wishing to ascertain how much the weight would decrease, he reweighed the one upon the 17th of February 1794, which produced 372 stones; and the other being reweighed upon the 26th of May 1794, produced 336: The first having only decreased at the rate of 7 per cent. instead of 33 per cent. as is commonly supposed; and the decrease of the second being 16 per cent." And, "by a similar experiment with the crop of 1795, he found the decrease of the weight of hay about 16 stones more in every 400 stones, than it had been in the crop of 1793; but says, that the hay was cut more green in the last, than in the first instance; which must always affect the decrease of weight for several months after hay is put into the stack." See *Clover*, *Rye-grass*, &c.

Rouen, or the second crops of hay, whether of natural or artificial grasses, will require less time in making than those that are first cut, as they are generally more slender, and contain less moisture than the first crops. In getting this sort of hay, care should be taken that it be perfectly dry when carried, as, without attention in this respect, it will be extremely liable to grow mouldy and bad in the stack.

It is remarked by the author of the "Synopsis of Husbandry," that, from the great mischief frequently accruing from stacking hay in a damp state, and the injuries of this kind which perpetually happen, one should suppose the farmers on the watch, and attentive to make use of every precaution to guard against it; but the many stacks, which are yearly fired in the neighbourhood of London, are a sufficient proof of their want of care in this particular. To prevent the fatal effects from the firing of hay, it ought, he says, to be a primary caution, that the fodder be thoroughly made; and that every lump of grass be intimately broken and divided, and have an equal participation of the sun and air; and that the operation be not hurried, either with a view to lessen the expense in making, or from an apprehension that rain may fall before the business can be finished; or from a presumption that the hay will weigh heavier in the turfs, if the whole has been got together before it be fully made, that it may thereby have the better chance of sweating in the stack. As to the first argument, namely, saving some expense in the wages of the labourer, it is, he says, so futile, as scarcely to deserve a serious answer; since the extra charges on this occasion can be but trifling, and are comparatively of no account, when set against the hazard of firing the stack; by which event, the owner may be involved in utter ruin. As to the second, or the apprehension of rain, his reply is, that it will be far more eligible to let the crop be spoiled in the field, than to run any hazard of its firing in the stack. And to the last, it may be observed, that hay, from upland meadows more especially, if put into a large stack, will be in little danger of losing either colour or weight by not heating. As to the low meadow, or marsh-hay, it may be got together with great expedition, as will be shown hereafter. In a wet season, at which time hay is under the greatest danger of firing in the stack, it seems the most eligible method to divide it into small parcels, as twenty loads in a stack, there being less danger of firing these small stacks, than when the hay is laid into those of larger dimensions.

The chief articles in stacking are, first, to select a clear sunny day for the purpose, and not to be sparing of hands on the stack, who, though they

may appear to stand over thick, will be all of them found of some utility, not only in keeping the stack well trodden in every part, but by shaking and tossing the hay abroad; whereby every particle of it will be again divided, and thus, by enjoying the benefit of the sun, it in a manner undergoes a second making. These precautions in employing a number of hands on the stack, and making choice of a fine day for the business, will at all times be found highly beneficial; but more particularly after a wet season, and which will, in some measure, contribute to revive the colour, and retrieve the smell of such fodder as may have been washed by continual rains in the first part of the haying. And, therefore, a farmer, who attentively watches the mutations of the weather, will always, he thinks, find his account in waiting a few days, when there seems a probability of a favourable change, rather than to begin his stack in a hazy day, and under the auspices of a cloudy atmosphere.

Laying up Hay. The most prevalent practice is, to stack it in the field, either for the purpose of foddering it on the ground, or to be fetched home in frosty weather, or when wanted. Much, however, is carried to the home-stall at hay time; some to be stacked; others to be housed; a practice which, when room can conveniently be had, seems to be in good estimation. It is at once got out of the way of the weather, and, probably, into the place in which it will be wanted: the mustiness of housed hay, which is talked of in some places, is not perceived in others.

The practice of stacking hay in the field adds much to the care and dispatch in hay-time. If the stack be placed in the centre of the ground, a considerable part of the hay may be collected without trouble of loading it on to a carriage.

If it be in large cocks, it is sometimes drawn to the stack with one horse, and a cart-rope put under the skirts of the cock, on the sides, and above the skirts on the back part, giving the bend of the rope sufficient hold of the hay to prevent its being drawn from under the cock. The two ends of the rope pass to a pair of hames, being made fast on one side, and kept in its place with a peg on the other: the cock arrived at the stack, and the peg drawn, the rope is disengaged.

If the hay be abroad, it is rowed in the usual way, and is sometimes drawn together with a long pole (six or eight feet long), with a rope passing through each end of it to the hames; a man standing or pressing upon the pole, to keep it down to its work, and make it clear the ground as it goes. This, however, though simple, is a difficult business. More complete implements of various constructions have, therefore, been contrived for this purpose.

These implements are also used in cocking; and, when the quantity of dry hay is great, and hands scarce, it eases and expedites the business very considerably. For, in this case, the main burden of hay is drawn together by the team; the rakes have only the bare ground to rake over, following the implement, and drawing the rakings to the part to be cleared by the next sweep of the implement, beginning on one side of the piece, and proceeding in this regular and expeditious manner to the other, leaving the hay in large rows, easily to be cocked, dragged to the stack, or loaded, as occasion may require. This expedient, however, is far from being in general practice.

When the ground, near the stack, is cleared, and the stack is risen too high to be conveniently forked on to or from the ground, the out-skirts of the field are drawn together in carriages.

In the best practice of some districts, the stacks, if not very large (which field-stacks seldom are), are never begun upon until a sufficiency of hay be dry, to get them above the eaves the first day.

If the whole be ready, the middles of the stacks are rounded up, and the remainder set in tall pikes by the sides of them, ready to be laid at the first fine day after the stems be sufficiently settled. This appears to be bringing the business of laying up hay as near perfection as the nature of it will admit.

In large stacks, it is a common practice to leave an opening in the centre, by drawing up a basket in that place, whereby a kind of chimney is formed, to convey the heat from every part of the stack to the air without.

They are, sometimes, perforated with holes for this purpose, having communications below, between the shaft and the external air, constructed of brick-work, somewhat similar to the common drain. Open hay-barns, covered with tiles, are, likewise highly useful, soon clearing the expenses of erecting them, in some districts. And the first is a good method to prevent the hay from acquiring too considerable a degree of heat in such large stacks; but, in those of a smaller size, the chimney had best be omitted, except in particular circumstances, as where the hay has been got together very green, or not perfectly dry; for, as the heat does naturally draw towards these vents or chimnies, the hay, in the neighbourhood of the chasm, throughout the stack, is often rendered of little worth. Another very material requisite at the time of stacking is, the possession of a man who is well acquainted with the art of setting up the stack, that it may stand firm and even, without warping to either side, and free from props or supporters, which have a very unsightly appearance, and should, if possible, be avoided; though it sometimes happens, that a well-built stack will show a propensity to bulge to one side, and therefore must be assisted with a supporter. During the time the stack is building, the middle part should always be left higher than the sides, that, if any rain should fall before the business is completed, the water may pass off with less danger. Near London, where the stacks are large, and therefore continue open for a week or more, the farmers usually cover the whole surface of the stack with a sail-cloth: this, when raised upon poles, so as to make a kind of roof, without coming into contact with the hay, is a very good method; but, where the cloth is left flat upon the sur-

face of the stack, though it may well answer the purpose of defending it against a sudden shower, yet, if much rain should fall, so as to soak through this temporary covering, it is supposed that the pressure of the cloth on the stack, added to the circumstance of its being so thoroughly moistened, would be rather injurious, than any real advantage to the hay.

Stacks are built in various forms: an oblong stack is by far the most convenient to cut from in the winter, if the hay is intended to be bound in trusses for sale; and this is the form in which the Middlesex stacks are usually constructed: but, when the hay is designed for the farmer's own consumption, round stacks are, in one respect, more eligible than the former, as there will be less straw required for thatching; and this, in counties where straw is dear, is a consideration of no mean import. A stack-place twenty-four feet by sixteen, will contain forty loads of hay, if well made and trodden at the time of stacking. The staddles for hay-stacks, as well as those of grain, should always be considerably elevated above the surface of the ground, by blocks of wood, or contrivances similar to those of grain. See *Stack* and *Stacking of Hay*.

It has been contended, that, by the use of salting, the necessity of having chimnies in stacks, and the danger of too much heat, may be avoided, besides its having other good effects.

And it has been supposed by many, that there is no great necessity for being so solicitous to have hay thoroughly dry before it is put into the stack, as it will keep perfectly well even with a considerable proportion of moisture; and, should any apprehension be entertained to the contrary, all danger will be prevented, by mixing it with salt; a practice strenuously recommended by many intelligent writers." But "trials carefully made, and upon a scale so extensive as to occasion very considerable loss to those concerned, prove, beyond a doubt, that the addition of salt to damp hay is no preservative against its heating; on the contrary, if moist weather follow immediately after it is put into the stack, the addition of salt, in place of being useful, will prove hurtful; it being a well established fact, that salt, and every thing impregnated therewith, greedily attracts the moisture of the atmosphere, and occasions a degree of dampness that would not otherwise have taken place. The experience of persons, who build houses with stones taken from the bed of the sea, is an undeniable proof of this: as the walls of such buildings are always damp and uncomfortable, even if they should stand for centuries, have we any reason, it is asked, to suppose that the case will be different when salt is mixed with hay? Either in a damp or dry state, if it is put into the stack damp, the salt will very effectually prevent its farther progress in drying, with this disagreeable addition, that if wet weather follow, the salt, by attracting an additional quantity of moisture, will increase the evil." And "the case is not materially different, when salt is mixed with even the driest hay, especially in situations where the climate is moist, and the winters long; for, if the quantity of salt employed is considerable, the continual attraction from the atmosphere during the winter months, if it does not destroy it entirely, will at least have the effect of rendering it musty and unpalatable.

"But though the writer disapproves the practice of salting hay when it is put into the stack, whether in a moist or dry state, there is every reason, he says, to believe, that it will be highly salutary and useful, if applied with judgment at a subsequent period. The beneficial effects of meadows or marshes that have been overflowed with salt water, upon the health of sheep and cattle, and the high relish they have for such pastures, are well known; the preference given by the animals is strong and decided: Is there any reason, he says, to suppose that an equal preference would not be given to hay tinged with salt?"

It is likewise added, that "in bad seasons, when hay has been much injured by the weather, it is not only tasteless, but disagreeable to the animals in the spring, who eat it only from necessity. When that is the case, it becomes an object to mix with it any article that can remedy these defects; for that purpose, nothing is better calculated than salt, which, along with its giving the hay an agreeable taste, has a medicinal effect upon the bowels of the animals; a matter at present too much neglected, while they are feeding upon dry food. The most proper time for applying the salt, seems to be a day or two before the hay is used. At that time, a quantity sufficient for two days' consumption should be taken from the stack, and laid either in a shed or barn; a thin stratum should first be spread upon the floor, and lightly sprinkled with water from the rose of a watering-pan; a small quantity of salt should then be equally scattered upon it; after which, another stratum of hay should be added; and the same operations of watering and salting repeated, till the whole quantity is gone through: it should then be well turned and mixed with a fork, and allowed to remain in a heap for one night; after which, it will be fit for use." But "it is, the writer says, necessary to observe, that the quantity of water applied, should never exceed what is necessary to damp the hay; and the proportion of salt should be confined to what will give it an agreeable flavour: a superabundance of either, in place of being useful, defeats the purpose for which they are applied. If there is too much water, it runs off, carrying the salt along with it; if too much salt, it renders the hay bitter. The salt made use of should be of the smallest kind, for the purpose of sprinkling it equally; and every possible means should be taken to prevent one part of the hay from getting more than another." It is, however, stated, as "worthy of notice, that though the salting of hay a day or two before it is used, is in general attended with advantages, it is to be understood as only for the coarsest kinds, or such as may have been injured by the weather; for, in every instance where it has been cut at the proper season, and well managed afterwards, the taste and flavour will be such as to recommend it to the animals, without any addition whatever; but, in unfavourable years,

when the quality is much impaired by the weather, especially if the hay is coarse, and treated in the manner commonly practised in the hilly and upland parts of the country, the operation of watering, with the addition of salt, will, by softening and giving it an agreeable taste, induce the animals to eat it with advantage, in many instances when it would otherwise be rejected. It is, perhaps, in such cases only, that salt can be useful, unless it be meant as a medicine; and it is very apparent, that the hint of using salt at all, originated in the preference given to salt-marshes over other pastures, by both sheep and cattle." It is probable, that from the advanced price of salt at present, it cannot be applied at all by the farmer in these intentions.

Mr. Marshall, in his Rural Economy of Gloucestershire, observes, that the degree of heat, which hay ought to be subjected to, is an interesting subject, but which is seldom agitated, and little understood, even in that county, where some little attention is paid to it. Something may depend on the species of stock it is intended for. The prevailing opinion there, he says, seems to be, that, for fattening cattle, it ought to be moderately, or somewhat considerably, heated. For cows, however, there are dairymen, who say it should have little or no heat, giving for a reason, that heated hay dries up their milk. These, however, he mentions merely as opinions: they may be well grounded or not. If not, they may excite a spirit of inquiry into a subject of some importance in a grass-land county.

Where it is necessary to ascertain the precise degree of heat in hay-stacks, there is, probably, no method more simple, or effectual, than that which was practised by the late Mr. Ducket, which consisted simply in thrusting a scaffold-bolt, or other stout and long iron bolt, into the hay-rick, to give an easy admission to a ram-rod, furnished at the end with a strong worm. With this he used to screw out a sample, and thereby discovered not only the heat, but also the colour of the hay; and, if the stack required air, he perforated it in several parts in the like manner, which answered every purpose of a chimney or funnel. But, where a hay-rick is discovered to be in a high state of fermentation, instead of throwing it down, which is apt to excite the heat into a flame, from the sudden access of the air, it is better to cut it in two, when of any considerable size; as, by such means, the danger will be immediately avoided.

It is further noticed by Mr. Marshall, that when a stack is properly finished, it will resist a good deal of rain without being hurt by it, because it then quickly begins to sweat; and whilst this heat continues, there needs no defence from the weather. When the sweating is over, and not before, the stack should be thatched, observing, if there has been much rain on it, that the top be perfectly dried before the thatch is laid on, otherwise the upper part of the stack will infallibly prove mouldy. It is a matter of some consequence, that the business of thatching be finished in a workman-like manner, that the roof may be smooth, and that the thatch be so firmly pegged on, as to be in no danger of loosening from the autumnal or winter gales, which would create an additional charge in the thatching, besides exposing the hay to the inclemency of the weather. For this reason, likewise, it is necessary that the stack-yard should be in a situation perfectly well defended from winds and storms, and that it be fenced from the inroads of cattle of every kind, otherwise the loss occasioned by their undermining the stacks will be very great. See *Thatching of Stacks*.

As hay is an article of such value and importance, it is worth while, the author of an Essay in the Farmer's Magazine observes, "to inquire what are the most advantageous and economical modes of using it. Every good farmer is now, he says, sensible that, when any considerable quantity of hay or other fodder is given to horses, sheep, or cattle, at once, the effect of their breath blowing upon it, joined to other causes, renders it so disagreeable, that they soon loathe and refuse to eat it: in that way, a considerable part of it is lost. On the contrary, when it is given frequently, and in small quantities, it contracts no disagreeable smell, and the animals eat up the whole. Farmers of a certain description will, says he, no doubt, object to this mode of feeding, on account of the trouble with which it is attended. With them, it is a maxim, that if the animals are fed once, or at most twice, in the twenty-four hours, it is sufficient; and that, if they are hungry, they run no risk of starving, while they have food so near them. They do not, however, reflect upon the injury, which the fodder thus used sustains by being breathed and trod upon, and impregnated with dung and urine. Let such men, continues he, consider how they would relish the remains of their dinner served up for supper, after being kept within a yard of their nose during the interval, upon the same plates, with the same knives and forks, without any washing or cleaning. There are few people, indeed, who would not nauseate and reject such a meal. The cause cannot, he supposes, be very different with any of our domestic animals, when they have, at once, a quantity of hay or other fodder given them sufficient for a whole day's consumption. Having it constantly in their sight, and being blown or trod upon, impregnated with urine, and otherwise injured, it becomes loathsome beyond description; and, in place of being eaten up, which it always is when small quantities are given at a time, and frequently repeated, a great part is rejected. It ought, therefore, he thinks, to be a rule, with all farmers, to give a little at a time, and repeat it frequently; always taking care, that what was last given be consumed before they receive an additional supply. By such management, no part of the fodder will be lost, and the animals will, at the same time, derive more benefit from the use of it as food.

"There is, also, another economical practice that remains to be mentioned, which is, the mixing of straw with hay. From many trials in different parts of the country, it appears, he thinks, that, wh

good straw can be had in plenty, it may be mixed with hay to great advantage. Some farmers are in the habit of mixing straw with cutting grass, the benefit of which will be afterwards noticed. When straw is mixed with hay, the process of curing may be accelerated, and the quality of the hay, at the same time, improved, by leading out the straw to the field, mixing it intimately with the hay immediately after it is cut, and putting the whole into small hand cocks as soon as it is mixed. It is well known, that, when moist and dry bodies are brought into contact, the former begin to give out part of their moisture, which is as greedily absorbed by the latter, and continues to be so till a balance is established between them; or, in other words, till both contain an equal proportion of humidity. This is precisely what happens when dry straw is mixed with green herbage. Immediately after they have laid together, the straw begins to absorb a part of the juices, and continue to do so as long as the grass will part with any. In that way, every part of the natural juices is effectually preserved, and the straw, from the absorption of what would otherwise have been either evaporated by the sun, or washed away by the rain, is rendered nearly equal in value to the hay. Where this practice is followed, and due pains taken in the mixing, very little exposure to the sun or atmosphere is necessary, and the hay will be fit for putting into the stack in half the time that is required, where no straw is used. But, in place of leading out the straw to the field, it is customary, in some parts of the country, to mix it with the hay in the stack, by laying alternate strata of each,—a practice that answers pretty well, but is much inferior to that above recommended. It may, however, be very useful in unfavourable seasons, and be the means of preserving hay that could not be cured otherwise.

It is added, that when straw is mixed with grass for present use, a quantity, sufficient for several days' consumption, should be cut at once; and, after mixing, laid up in pretty large heaps, and allowed to remain in that state for a couple of days at least: at the end of which, the straw will be found much softened and impregnated with the juices of the grass. When a fair trial is given to this practice, several advantages will, it is conceived, be found to arise from it: the first is, the conversion of a considerable quantity of straw, which would otherwise have been of little value, into a wholesome and nourishing article of food; the second, that grass so mixed has not that purgative quality it is known to possess, in its simple state, and seems to keep the bowels in a medium state, preventing alike the extremes of scouring and costiveness, circumstances of much importance to the health and strength of the animals. It has also, he says, been recommended, and, to a certain extent, practised by some farmers, to mix old and new hay. Upon this point he has simply to observe, that if old hay has been got well, and properly secured in the stack, it will be found, for many purposes, superior to new hay: it certainly contains a firmer and more concentrated nourishment than new hay can possibly do; and, for all animals that are employed in constant and severe exertion, it is infinitely preferable. There is a period, however, beyond which even the best old hay will, by being excessively dried, begin to be impaired in its quality, and be eaten with much less relish. In such cases, a mixture of new hay may be useful; as the old, by the absorption of the new juices, will recover a part of the moisture and flavour it had lost by long keeping. The same thing will happen, if the hay of the former year has been of an inferior quality, owing either to its having been allowed to stand too long before cutting, or to its being bleached with rain after it is cut. In either of these cases, the defect will, it is conceived, be in some degree repaired, by mixing it with new juicy hay that has been made from well-flavoured herbage.

Mr. Marshall, in his Minutes of Agriculture, says, "he adopted the following method of making mix-grass and clover hay with advantage:—let it lie awhile to wither in swath; but while it is tough, before it be crisp, make it into light minikin cocks, and rake the bared surface. As the cocklets become dry, aggregate them, and continue to rake the bared grass till the hay be dry enough, and the cocks big enough. If rain beat down the cocklets, catch a dry opportunity of turning them upside down, and lightening them up,—not shaking them up. Thus they will be always out of harms way, and the leaf, sap, and colour, will be preserved. Never ted a light or a middling crop of grass, of whatever species. If the weather be fine, let it make itself in swath; if foul, make it into cocklets. Hay makes faster, it is observed, in heaps, of whatever shape or size, than is generally imagined, especially in windy weather. It is amazing, he says, how much large heaps dry after they are mixed and shook light up."

HAY-*Band*, the twisted hay-rope, with which trusses of hay are bound up for sale. The coarse fusty outside parts of the stacks is mostly made use of for this purpose, which prevents the loss that would otherwise take place.

HAY-*Barn*, that sort of barn which is constructed for the purpose of containing hay. Barns of this kind are mostly formed of wood, without having bays in them, as is often the case in other barns.

It is observed by Mr. Middleton, that, "in the neighbourhood of Harrow, Hendon, and Finchley, in Middlesex, there are many hay-barns capable of holding from 30 to 50, and some even 100, loads of hay. They are found to be extremely useful and convenient during a catching and unsettled hay-harvest*, and also at other seasons of the year. In wet and windy weather, they afford an opportunity of

* In the very common case of approaching rain, when the hay is fit to be carried, every nerve is exerted to secure as much of it as possible; and that is certainly best done by getting all the carts loaded and drawn into the barns, and the hay quickly pitched on to the mows, and there left in the lump to be spread at a time of less bustle, at least from so many of the carts as the time and weather will admit of being re-loaded, and again drawn into the barns. When rain falls, no apprehension need be en-

cutting, weighing, and binding hay; none of which operations could, at such a time, be performed out of doors. The farmers, whom he has consulted on this subject, agree that hay may be put together earlier, even by a day, in a barn, than it would be safe to do in a stack. They advise, however, that the sides of the mow should be raked or pulled clear of the quartering of the barn; and, when thus managed, they are of opinion, that the hay will be as good in the barn as in the stack." He finds that, "in the *driest seasons*, barns are a saving of four or five shillings an acre; and, in *wet* seasons, the ready assistance which they afford, in speedily securing the hay, has been known to make a difference in price of *twenty shillings* per load on a small number of loads." This is from his own experience, and the opinions of the best hay-farmers. The increasing expense of straw, renders these buildings still more necessary. That hay will keep equally well in them, there can be no doubt, as in Lancashire, and many other northern districts, little or no hay is stacked.

Some, in the above hay-districts, however, think, he says, "that hay put into barns is apt to be dusty on the sides next the boards; and that, from the smallness of the quantity put together, it has too much outside, and consequently subject to be over dry." That, in this case, it should be sold before Lady-day. But these objections, the above writer "cannot but think, are, in a great measure, unfounded. The second can certainly only happen where the barns are too small; and, as to the others, he can answer, that he has had three barns at a time full of hay: the boards and quartering were swept clean immediately before depositing it: they were filled completely; and he had the hay trodden down as much as possible. The sides of the mows were neither raked nor pulled, as he was of opinion that such a measure would be an unnecessary loss of room. When this hay came to be bound out, the whole was found to be perfectly free from dust, of good smell and colour*, and sold at as high a price as the best hay from the stack-yard. It was all made without receiving any rain, and that which was least prepared was put into the barns." See *Burn*.

HAY-*Binder*, a person employed in binding hay up into trusses for the market. Labourers of this sort mostly work by the load, the price for which varies from 2*s.* to 2*s.* 6*d.* and 3*s.*

HAY-*Binding*, the practice of putting hay up in trusses. The art of binding hay is an employment at which the labourer makes much better wages than at almost any other, and at a season when other workmen in general earn least, as in the midst of winter. But there are few that attempt this business, and fewer still who are capable of executing it with propriety. Those, who are expert at it, can judge, by the appearance of the truss, and balancing the same in their hands, when it is of a proper weight, often without having recourse to the steelyards; so that, when they have opened their stack, and cut out a few loads from the top, which is always the least weighty, the business goes on with great dispatch, one man being employed in cutting, and the other in binding up the trusses. Where the hay is good, and has taken no damage from wet, or from heating in the stack, there is not the least atom thrown to waste in the binding. The loose locks are put into the middle of the truss, so that it may have the more sightly appearance on the outward surface; and the bands are made with the hay, there being a penalty inflicted by the act of parliament on the use of straw-bands. The binder always finds the steelyards and the other implements that are necessary for the purpose.

HAY-*Bote*, a term applied to a kind of feudal right, by which a tenant for life or a term of years has a liberty of taking bushes, wood, &c. for repairing fences, gates, and the like. It also signifies the liberty of cutting wood for making rakes and fork-handles, used in making hay, &c.

HAY-*Fork*, the fork employed in making hay, and pitching it to the cart, mow, stack, &c. For the first purpose, the prongs need not be so long; but, for the latter, they should be of a good length, and inclined a little forward.

HAY-*Knife*, a sharp instrument employed for cutting hay out of the stack or mow. It should always be kept free from rust, and perfectly sharp. An improvement in this implement is said to have been made, by having it constructed somewhat in the form of the common spade, sharp on the sides. With this tool, the workman cuts directly downwards, instead of the oblique direction, as with the old implement.

HAY-*Sweep*, an implement contrived for the purpose of collecting and conveying hay to the stack in an easy and expeditious manner after it has been put into rows. This sort of implement is used when the hay is stacked in the field; in which case, it saves much time and labour; as, in this way, the hay may be got together with fewer horses than by means of waggons or carts.

An implement of this nature, used in different parts of the North Riding of Yorkshire, is described in the Agricultural Survey of that county, and represented at *fig.* 2. *pl.* L. *A*, is a view of the whole sledge. *B*, the frame of the bottom, which is boarded on the top-side, as shown at *A*. *C*, is one end, with the top-rail springing from it. *d d*, are two pieces of iron fixed on the frame *B*, with nuts and screws: on each side is a ring, to which the horses are hung, one horse going on each side of the row, whilst the sweep has got sufficiently loaded, when one horse crosses the row, and the load is taken to

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tertained; for, by only shutting the doors, the hay is effectually secured against even the dews. In case the weather should continue unfavourable, the full carts that are in the barn can be unloaded, and the mow may be pulled, trodden down, and put to rights.—*J. M.*

* Except only the smell of such of the hay as lay against the weather-boarding, on the shady sides of the barn: but even this was confined to the surface. It was without dust, and no way injured in its colour.

the stack. When arrived, the horses are turned about, and the rings run to the other end of the irons. The sweep is then drawn back (leaving its load), and proceeds to collect another.

A machine of this kind has likewise been invented by Mr. Middleton. This is drawn by four horses in pairs, with a boy to manage and drive each pair. But, before it can be wrought, it will first be necessary that the hay should be put into rows, as is universally done before the loading of carts, waggons, or sledges. Then, in order to sweep the hay together with greater facility, a man, with a fork, must turn the end of a row up two or three yards, so as to form a sort of heap; and then walk on ten, twenty, or forty paces, and break the row by turning the hay forward into another similar heap, going on and repeating this operation to the end of the row, which he should do as fast as he can walk. Then the boy, who has the management of that pair of horses to which the empty machine is attached, must draw it across the end of the row, and, the moment the centre of the machine is at the middle of the row, let him turn his horses short round, to within a yard or two of the hay, so as to be in a proper situation to set off. The other boy must instantly place his horses on the opposite side of the row, and hook the chain of his splinter-bar to the machine, pulling the gate or side of the machine round, so as if it were to clasp the hay, as at *A*, *fig.* 3, in the same plate. The boys being mounted, and every thing ready, let them draw slowly for the first twenty or forty yards: they may then, if the business requires dispatch, increase their pace, urging the horses on to their fastest walk, and from that into a slow trot, until as much hay is collected as the horses can draw; then, unhooking one end, let the horses at the other turn from the hay, and draw out the machine from behind it; then trot away to the end of the next row, and repeat the process, taking care to keep the horses on each side of the hay, at equal distances from the row, and opposite to each other. When the machine is loaded, and the intention is to draw the load to a distant place, the four horses cannot be kept too near together.

The elevation of the machine, as it appears when drawn by one end, and empty, is shown separate in the plate, where the scantlings of the several parts of the machine are marked.

The plan of the machine, when in the action of drawing the hay, is shown at *B*, by the letters *a,a,a,a*, which are the places occupied by the horses when drawing (though, in many cases, one horse on each side would be sufficient); *b*, the back or principal part of the machine; *c,c*, the sides of the machine, which swing on the iron rods fixed in the back, at *d,d*; *e*, the row of hay.

This may be an useful machine in many cases; though, probably, less simple in its construction than the former.

Hay-*Sow*, a term applied to a sort of oblong rick. See *Stack*.

Hay-*Tea*, a sort of infusion made by pouring boiling water upon hay, that has been cut by a machine to the length of about an inch; the whole being then, in some cases, mixed with ground or bruised grain. This composition, in the proportion of about two or three quarts to each cow every day, has been found, by Mr. Harper, as stated in the Agricultural Survey of Lancashire, to improve the flavour of the butter, and restore it to its proper yellow colour. It may likewise be useful in rearing young calves when mixed with the milk, and given as their food, having a highly nourishing quality. In the store feeding of hogs, it has also been found, in the trials of Mr. Saunders, to be a cheap and convenient article of food; but further experiments are wanting to fully establish its utility. The statements of Mr. Saunders may be seen in the second volume of the new series of the Agricultural Magazine. In these cases, it was supplied in the form of soup, thickened with some other cheap substance. See *Swine*.

HAYN, a term that implies the act of inclosing with a hedge or other means, in order to preserve grass-grounds from being pastured with cattle or other animals. Thus, to *hayn up* signifies to shut up grass-lands for the purposes of being mown or fed off afterwards.

HAYWARD, a term that formerly signified a keeper of the common herd of cattle of a town, who was to look that they neither broke down nor cropped the hedges of inclosed grounds, and who was sworn in the lord's court for the due performance of his office.

HAZEL, a small tree of the filbert kind, sometimes used in making hedges. Also for constructing wattled hurdles, &c.

Hazel-*Mould*, a yellowish kind of friable mould, of a loamy quality. It is usually met with where the land is of a good kind. See *Mould*.

HEAD, that part of an animal which contains the brain. With respect to "the diseases of the head, properly so called, they have their origin and immediate cause from the head, and are not, as in the case of staggers and convulsions, merely symptomatic." The kinds of which are all those which proceed from extravasated matter discharged out of the veins or arteries upon the brain or its membranes, whether the effect of wounds or concussions, or proceeding from any other cause by which the vessels of the brain may be ruptured. In some cases, the membranes themselves are indurated, and grow preternaturally hard and distended by long-continued obstructions, so as to press upon the tender substance of the brain. This may also be owing to some previous accident or disease. "In some old animals, the membranes have been found ossified, and incapable of their functions, causing great disorders in the head. Sometimes these proceed from a determination of blood, when the circulation through the vessels and sinuses of the head happens at the same time to be sluggish. This last is generally owing to a fulness or too great quantity of blood in the system, which is often the case with horses that are fed high, and have neither had sufficient exercise, nor other proper means used to preserve their blood and

juices in a proper state. From these and such-like causes proceed most of the diseases peculiar to the head, such as apoplexy, vertigo, lethargy, epilepsy, paralytic disorders, and all others where the nerves are so affected as to impede sense and motion."

HEAD, a term provincially applied in the grazing of bullocks. to the first bite of grass, when they are said to *go a head*, in contradiction to the *followers*.

Head *of a Horse*, in *horsemanship*, the part on which the bridle is fixed. It should be narrow, lean, and not too long; but the main point is, that of having a good onset, so as the horse may be able to bring it into its natural situation; which is, that all the foreparts, from the brow to the nose, be perpendicular to the ground; so that, if a plummet was applied thereto, it would just raze or shave it. Horses, that have large heads, are apt to rest and loll upon the bridle, and, by that means, tire the hands of the rider; and, besides, they can never appear well with large heads, unless they have also long and well-turned necks. It also signifies the action of the neck, in the carrying of the head.

Head-*Ach*, in *farriery*, a pain which in animals is not easily ascertained, but which is supposed to be present, when there is a hanging down of the head and ears, dropping of urine, dimness of sight, swoln watery eyes: these are, however, common to some other diseases; and it is, in fact, difficult to conceive that a head-ach can be easily distinguished in brute creatures, that want the faculty of speech to declare their sensations. But, where a horse has such symptoms, without a fever, and if it be observed that he often puts his head against the stall or manger, as if to relieve pain, it will be very proper to have recourse to some remedy. For which purpose, Gibson recommends bleeding, purging, and rowelling.

Head-*Keep*, a term provincially signifying the first bite, or best keep the farm affords for live-stock.

Head-*Land*, a term applied to the lands or ridges at the tops and bottoms of fields, on which the plough turns in cultivating them. As much soil is continually accumulating on them, by means of the frequent ploughing of the field, it is of importance, in some cases, to form them into composts with lime or other manures.

This may, in many cases, be performed by means of the plough, though not perhaps so effectually as by the spade. By the former method, there must, however, be a considerable saving of both expense and time. The best manner of converting the surface soil of head-lands into composts, by means of mere plough labour, is that of first ploughing such lands repeatedly through summer, to clean and pulverise the soil; and also to mix the lime very minutely, applying the manure, whether lime or dung, in a thin and even manner over the whole, and beginning to plough in the middle. After the lime has been thus minutely incorporated and blended with the mould, the dung may be applied and blended in the same way. See *Compost*.

When the soil of such head-lands is stiff and clayey, it may be necessary to lay it up in high ridges during the winter season, in order that it may be mellowed and broken down by the frost, harrowing it well in the spring, and then blending the lime and dung with it in the manner directed above.

When lime alone is used, the compost may be very completely made by the plough, taking care not to lay the whole lime on at once, but at different times, ploughing and harrowing well after each liming. And where dung is employed in this way, it may be incorporated in the same way after the operation of the lime has been performed in the soil.

Head-*Stock*, a term applied to the first or leading stock in grazing-lands.

HEALTH, that state or condition of an animal in which all the actions proper to the body are performed in the most perfect manner.

It is considered by Gibson, "as a sure maxim, that, when a horse is in good plight, that is, when he eats his allowance of hay and corn, drinks a moderate quantity of water, endures exercise well, without being faint and dispirited; when his exercise does not take him off his stomach, but rather quickens his appetite, when his coat lies smooth and looks well, he may reasonably be concluded to be in health. And that to give him medicine to prevent sickness must in a great measure be superfluous, if not hurtful. Yet some, says he, are not satisfied when the horses have all their usual signs of health, but order them to be bled and purged often, whether they really stand in need of it or not, according to an absurd custom, which seems to prevail with us more than with any other nation. Others think their horses cannot continue in any degree of health without cordial balls, which are generally given with a view to carry off imaginary surfeits, to create a good appetite when it is not wanted, and to preserve their wind when it is in fact in no danger.

HEAT, the pleasing sensation or effect produced in the body by the action or operation of a peculiar subtile fluid matter, to which the title of *caloric* has lately been given.

It is observed by Dr. Darwin, in his Phytologia, that the fluid matter of heat is one of the most extensive elements in nature, perhaps next to that of gravitation: all other bodies, says he, are immersed in it, and are preserved in their present state of solidity, by the different attractions of their particles to the matter of heat, which thus counteracts the powers of gravitation, and of chemical affinity, which would otherwise compress them into one solid chaotic mass. And that since all known bodies are contractable into less space by depriving them of some portion of their heat, and as there is no part of nature totally deprived of heat, there is reason to believe, that the particles of bodies do not touch, but are held towards each other by their self-attraction, or recede from each other by their attraction to the mass of heat which surrounds them, and thus exist in an equilibrium between these two powers. If more of the matter of heat be applied to them, they recede further from each other, and become fluid.

If still more be applied, they take an aërial form,

and are termed *gasses*; and it is probable, that the ethereal fluid of electricity may also be diffused with heat, as well as the ethereal fluid of light.

Thus, continues he, when water is heated to a certain degree, it would instantly assume the form of steam, but for the pressure of the atmosphere, which prevents this change from taking place so easily. The same is true of quicksilver, diamonds, and of perhaps all other bodies in nature: they would first become fluid, and then aëriform, by appropriate degrees of heat. On the contrary, this elastic matter of heat is liable, he says, to become consolidated itself in its combinations with some bodies, as certainly in nitre, and probably in combustible bodies, as sulphur and charcoal. This combined heat is universally set at liberty in the production of acids, by the union of oxygen with all inflammable bodies. It is also taken from some bodies by the vicinity of very cold ones; as water, when frozen, loses suddenly a part of its combined heat at the moment it becomes ice.

And Mr. Van Uslar, in his Observations on Plants, remarks, that this elementary principle existing in all bodies manifests itself in numerous phænomena resulting from its effects, and that it exists in different states, according to circumstances. That in one (probably its original state) it is not perceptible by our organs of sensation, and is apparently inactive upon other bodies existing within its atmosphere. This state of heat, properly defined *latent heat*, is, he says, the source of all its other states, in which it becomes so powerful an agent for innumerable purposes necessary for organised bodies. For the complete discovery of this, which has led to so many subsequent useful discoveries in chemistry, we are indebted to Dr. Black. This latent heat is found to exist in different proportions in different bodies; and bodies have different capacities of imbibing, accumulating, and combining with it.

But the other state of heat, which is that in which it manifests itself to our organs of sensation, and in which it becomes active upon bodies presented to it, is occasioned by different causes. For instance, says he, latent heat is set at liberty, so as to become active by certain exchanges of the condition or component parts of bodies resulting from superior elective attraction among heterogeneous bodies, when brought into near contact, as we observe by the separation and exchange of the basis of oxygen gas in the process of combustion and respiration:—by the conversion of vapours into liquids, and of liquids into solids; by the crystallization and sudden concretion of saline vegetable and animal fluids; by the sudden absorption and condensation of fixed air and water by earths, &c. But whenever heat, in any of the above-mentioned cases, is set at liberty from a body, it always discovers a tendency to enter and pervade another presented to it, owing to its general attraction for all bodies; on which account it cannot, it is conceived, be confined nor exist in a perfect, free, or uncombined state.

It is supposed, that the different degrees in which heat become more or less perceptible and active, when set at liberty, will be in proportion: first, to the quantity of latent heat in bodies; secondly, to the quantity which is separated in a given time from bodies acting upon one another. Its effect on the substances, to which it is applied, will be according to the velocity with which it can enter that body, and also in proportion to the capacity of the ambient or intervening medium for accumulating or retaining it. If, for instance, a homogeneous body, or a chemical compound, be exposed to such a degree of heat as is incapable of destroying the chemical attraction of the parts of the compound, it will then gradually produce an equal effect upon such aggregate; namely, it will merely enter, occupy, and be accumulated in the most minute interstices of that body, and thus exert its expansive force, or self-repelling power; and thereby increase the bulk of the body, diminish its specific gravity, and occasion an alteration in it, which will continue only as long as heat is supplied; and the expansion will be in proportion as the quantity of heat supplied can overcome more or less the power of attraction of cohesion of particles under the pressure of the atmosphere. In this case, on removing the body from the supply of sensible heat, its parts will resume their former state, without having undergone an alteration in their nature, consequently the heat applied to such had only produced a temporary effect. Examples of this we observe in the conversion of ice into water; of water, or spirits of wine, or essential oils, into vapour; in the melting of wax, fat, gelatinous matter, metals, &c. There are other cases, in which sensible heat, when induced in a moderate degree upon bodies of a heterogeneous mixture, will first occasion a similar effect; yet such bodies will be more or less decomposed or destroyed by an intense degree of heat.

It is added, that in respect to instances of the effect of a moderate degree of heat occasioning a mere separation of the constituent parts of a mixture, without the production of a new compound, we can observe, on applying a moderate heat to a mixture of fixed salt and water, of spirits of wine and water, of water and earthy matter, to animal and vegetable fluids, oils, and other vegetable matter, &c. In this case, the applied heat first pervades and expands the mixture, and then, accumulating gradually, exerts a different effect upon each of the bodies, which effect will be in proportion as their capacity of retaining heat is to the power of attraction and cohesion between the particles of each of the bodies in the mixture. If, therefore, the capacity of one of the bodies (as water) for accumulating heat exceeds the power of attraction of cohesion among its particles, and if the power of attraction of cohesion among the particles in the other body (as salt) exceeds its own power of accumulating heat, then the expansive force of heat upon the particles of water will be greater than that upon the particles of the salt; and as thus the specific gravity of water is diminished, the latter will consequently separate first, and will remain suspended in the atmosphere, until it part again with that heat. When this happens, the water recovers its former state, and the salt remains

undecomposed, parting likewise gradually with its share of accumulated heat, and then the applied heat will be set at liberty again. Another effect of sensible heat, applied in a great degree to bodies of a heterogeneous nature, is a more permanent alteration, or a total exchange, of the component parts. Here a certain portion of sensible heat combines chemically, or more intimately, with some of these parts, and becomes thus latent, producing a new permanent and elastic compound (or gas), in which the heat remains in combination in the temperature of the atmosphere; in which it then exists, and can, from that state, be separated only by exposing it to such a body as has a superior elective attraction for the substance to which it is combined. For instance, if we expose animal or vegetable juices, inclosed in a vessel, to a moderate heat, we observe that the aqueous or more valatile parts first separate, and the less valatile remain; but, when more heat is applied, then an exchange or new combination of the component parts of the residuum will take place, and part of the applied heat will enter into a chemical or more permanent union with some of the principles of the compound, and produce thereby hydrogen gas; or it will combine with a new compound, as carbonic acid, and form the fixed air. Thus we perceive, that no specific effect can be appropriated to sensible heat, since much depends on its quantity, and on the dispositions of bodies, either to accumulate merely, or to combine it.

It is further remarked, that sensible heat, applied in a moderate degree, promotes vegetation in a variety of ways: it excites the activity of plants; it promotes the disposition of some of their constituent parts for new attraction and combination to obtain such substances as may be requisite for their growth; it likewise causes them to reject such matters as would be hurtful to them, in retarding their growth, &c.; it promotes the dissolution or digestion, the formation and secretion, of their different products. It supports the irritability of some of their parts, in disposing them to acquire and to retain a due proportion of the principle (the oxygen) which causes their irritability, and in preventing also the accumulation of this principle in plants, which may become hurtful to them. It renders their food and juices, &c. more fit for penetrating and passing their different conducting canals, and enables them to dispose of their superabundant portion of fluids, by promoting perspiration and evaporation.

It is active in the production of electricity, which likewise assists vegetation.

It is also added, that sensible heat becomes likewise useful to vegetation in another way, after plants and animals have finished their period of life, or when purposely deprived of it: heat then occasions a dissolution and new combination of their component parts, by fermentation, &c. according to the nature of the vegetable or animal matter, and thereby promotes the preparation of new food for living plants. This is the case in the formation of manure. See *Manure*.

These are the numerous beneficial effects, which heat has upon the process of vegetation.

But heat may prove fatal to the constitution of plants, when applied in a too great degree, and for too long a time; as this may occasion a too rapid digestion and perspiration of their nourishment, and consequently an exhaustion. In such cases, plants will only recover by diminishing gradually the application of sensible heat, either by occasioning a slow evaporation of water upon their parts, or by other means. It is believed by Lord Dundonald, in his treatise on the Connexion of Agriculture with Chemistry, that the frequent changes in the degree of heat and cold in the atmosphere, are to be ascribed more to the alternate disengagement and fixation of heat by chemical combiuation, than to the effects of the solar rays. See *Plant*.

HEAT, in *horsemanship*, a term used on the turf, to denote a certain distance which a horse runs on the course. A race may consist of one or more heats.

HEATH, a well-known plant, growing on many of the more poor and exposed moors and commons in great abundance. It has many different names, such as *heather*, *ling*, &c. in different places, especially in the northern parts of the island. The sheep are fond of cropping it; and, in Norfolk, they have been found, in some instances, to succeed better, and be more free from disease, when kept in situations where it prevails, than under other circumstances.

In the first volume of the Farmer's Magazine, some observations occur on its use; and a plan is suggested for the purpose of converting it to the use of winter fodder, in cases where green crops in that view cannot be grown to any extent. The writer states, that, "from the experience of ages, it is known to contain a wholesome and palatable nourishment, when eaten in a green state; and it is well known, also, that every kind of green herbage, hitherto employed for feeding domestic animals, is likewise calculated to support them in health and vigour when dried, provided it is cut at a proper period, and due pains taken to preserve it. The value of the different kinds of straw and hay is so well known, he says, that it would be absurd to attempt any reasoning upon it. Have we the least room, he asks, then to suppose, that heath, if cut at a proper season, and well managed afterwards, would not also be found highly useful? Growing, says he, in situations where scarce any thing else will thrive, the qualities of heath have not only been overlooked in many instances, but its very existence deemed a reproach upon the soil. That it was not considered in the same light by our ancestors is, he thinks, evident, from their understanding its qualities so well, as to be able to prepare from it a fermented liquor, of a highly agreeable flavour, and an intoxicating quality, which was used upon all their great occasions. Indeed, we have a tolerable confirmation of this fact, by attending to the pasture of bees upon heath; from which, in a given time, they collect more honey than is usually done from the richest fields of white clover during the same space: and, as it is now ascertained, that the food of bees is derived from the saccharine or fermentable

matter contained in the flowers upon which they feed, and which acquires the distinguishing properties of honey, merely by passing through the vessels of the insect, and the particular organization of these vessels, it may safely be inferred, that heath, when properly managed, contains properties greatly superior to what it is generally thought to possess. Were any doubt to remain, additional conviction would, he conceives, arise from the high flavour and other qualities of the Highland mutton, so justly celebrated over the whole island, reared in situations where the animals have not any other food but heath."

And he adds, that, "in Sweden, the practice of cutting heath for winter food has long prevailed; and the heath-harvest, in some parts of that country, is as regular, and as much attended to, as the corn-harvest in the most fertile provinces. Long experience has taught the natives its value, and furnished an example that ought to be followed by other nations, similarly circumstanced as to soil and climate. In that country, it constitutes a bulky and essential article of winter food, in many situations where no other can be obtained. Little coarse hay is produced in the Swedish hills and uplands. Sown grasses are unknown. Straw and turnips are equally scarce, except in the corn provinces; and, even there, the only broad-leaved crop cultivated for winter food is the roota baga, or Swedish herb; a vegetable that unites, in a considerable degree, the qualities both of the cabbage and turnip. But, allowing turnips, hay, and other articles, to be produced in much greater quantity than they are, even in the most fertile of the Swedish provinces, it would be found impossible to transport them to the higher districts, owing to the very inaccessible nature of the country, the badness, indeed the almost entire want, of roads, and other unfavourable circumstances. Thus insulated, and cut off as it were from every supply but the produce of their own mountains, necessity has, he says, with the boors of Sweden, become the parent of industry and invention, and taught them to appreciate the value of an article (despised or neglected in other countries), which they find fully adequate to their wants, and have for the trouble only of cutting and curing. Were we, continues he, simply to reason upon the subject, we would suppose, that a practice which has obtained for a length of time in any country, and from experience been found useful, would be adopted in every similar situation. Britain resembles Sweden in many respects. Both countries can boast of the most fertile corn provinces in Europe, and, in both, there is a large extent hilly and mountainous. It is well known, that these parts of Sweden, by the industry of the inhabitants, are rendered highly productive, principally by their management of heath. Have we any reason to think, that the produce of the hilly and mountainous parts of Britain would be less valuable, or of a quality less nourishing? The soil is, in every instance, equally good, and the advantage, in point of climate, greatly in our favour. This last circumstance renders the cutting and subsequent treatment much easier in this country, than it possibly can be there."

It is further stated, that, "at present, the usage of the high lands and uplands throughout Britain is to burn the heath, with a view to improve their pasture. By that operation, the tops of both heath and grass are completely destroyed, and a considerable time elapses before new shoots are produced; whereas, were the heath cut for winter food, in the way we have mentioned, it would, he says, send out new shoots the following spring; which, being of a tender and succulent nature, would form a palatable article of food for sheep, with this additional advantage, that the grass which grows amongst it would spring up at the same time, and add to the value of the pasture."

It is supposed, that "in cases where heath grounds have been cut or burnt for a few years, if the surface is tolerable smooth, the heath may be cut with a strong scythe; but when it is of many years growth, and the stems have become hard and thick, that instrument will not be so very proper, as it is liable to bend, and get out of shape, and little work can be done with it in a given time. Other instruments have been proposed, and certainly might be employed with advantage; but farmers, who are not in possession of these, may make very satisfactory experiments, by cutting it with a common hedge-bill, an instrument with which a labourer can cut a considerable quantity in the course of a day."

And "with regard to the time of cutting, that should, the writer thinks, be determined by the season, and other circumstances. Experience, which, in every case where it can be resorted to, ought to be the standard, both of opinion and practice, establishes the fact, that cutting at an early period of the season is the most certain way of obtaining a valuable and nourishing herbage. When we say early, no particular month, or period of any month, is meant; earliness depending entirely upon the season, which, in an insular situation, like that of Britain, is very variable. The most certain criterion is, the progress the plants have made in their growth; as, at a certain stage, they possess properties, which are either impaired, or entirely lost, if they are suffered to stand longer. Perhaps, when the flowers are fully expanded, the heath will be found most nourishing. Indeed, shepherds and others, who have paid much attention to the subject, think the pasture most valuable during the time it continues in bloom. If possible, it should always be cut during dry weather, and immediately thrown into cocks or heaps, where it may remain for a week or ten days; after which, it may be put into large ricks, and allowed to stand, till it is found convenient to carry it to the situations, where there is a chance of its being used through the winter." That this plant may be found useful in this way seems not improbable, from the use that has been made of it in other countries; and to sheep-farmers in particular situations it might be found highly beneficial, at least trials may be cheaply made, and they certainly should not be neglected.

This material has likewise been found useful in other applications in different situations; as in the thatching of farm-buildings, the making of brooms, &c. See *Heather Roofs*.

HEATHY *Land*, that sort of waste, moor, or other ground, which is much covered or overgrown with heath. In many districts of the kingdom, there are immense tracts of this sort of land, that, in their present state, afford little, except the support of a few sheep; but which, by proper cultivation, might be brought to afford useful crops of various kinds. They, however, differ much in their nature, both in respect to the properties of the soils, as well as the quantities of heathy matter by which they are covered, and must of course vary much in the manner of their culture, according as such circumstances are more or less prevalent. Where they are thickly covered with the heath plant, the best method of management, in order to get quit of it as quickly as possible, is, to have recourse to the practice of paring and burning, as by this means it is at once destroyed, and the land brought to a state fit for cropping; while, in the contrary method, it requires a great length of time to rot and decay, during which the land is kept in much too open and loose a state, by the heath, to afford good crops of almost any kind.

In most lands of this sort, the paring should, however, be executed in as thin a manner as the nature of the case will admit, and the ground be afterwards cropped in a proper manner, so as not to have its fertility in the least diminished by the too frequent repetition of grain-crops, as is often the case. In many instances, it may be the most beneficial practice to restore the land, as soon as possible, to the state of grass or sward, to be fed with sheep or other animals.

Vast tracts of this description of land, in different parts of the kingdom, have lately been broken up and managed in this way with the greatest advantage and success. See *Paring* and *Burning*.

Lands of this kind are, however, not unfrequently broken up without the practice of paring and burning; and, where there is but little heath, this method may answer, and probably save some expense.

It is stated by Mr. Curtis, of Norfolk, that he had an acre of land, which laid adjoining to another, of a similar soil and situation, belonging to a neighbour. It was of the old heath kind, which had never been ploughed, and of a lightish moderate quality. His land was, he says, sown with oats on the flag, and, in the ensuing winter, had a coat of marl of sixty loads per acre. "It was then," says he, "sown with turnips, and laid down with red-clover, trefoil, and rye-grass, agreeably to the practice upon the neighbouring lands. In this state it remained two years, and was afterwards subjected to the same rotation of cropping, &c. as the rest of the farm. During the continuance of his lease, this land had invariably the advantage in produce of all the rest in his occupation. The land belonging to his neighbour was fresh sown with oats, then with wheat, and then once more with oats; after which it was marled, exactly as he has described his own. The result was, that the two oat-crops produced about six quarters each per acre, and the wheat about three, but they appeared to have nearly annihilated the fertility of the soil. It was seven years under his observation, and he never saw one crop afterwards that paid the expense of seed and culture. From hence it may be inferred, he thinks, that land of a slight texture of this kind cannot be too sparingly cropped on its being first transferred from grass to tillage."

But Mr. Wedge states, that he pursued the following method with a very poor piece of heath land, which he wished to lay down in sainfoin as soon as possible. He pared and burned it, sowed it with cole-seed, which he let stand for a crop, with a view to mellow the land, and destroy the turf as much as possible. As soon as the crop was off, he made it very fine, by ploughing and harrowing it very well, and, as soon as he could procure new sainfoin-seed, he sowed it with rye: he ploughed about half the seed in, and harrowed in the other half, five pecks of rye, and four bushels of sainfoin. This happened to be in the first week of August. He had a very good crop of rye, and an excellent plant of sainfoin. He let the stubble remain upon it all winter, which sheltered it so much, that he turned his cows upon it in the month of March, and it was an excellent pasture all the summer. He did not feed it down close, and it now looks extremely well. He cannot finish this account without mentioning an experiment that he made on this piece of land, when he began to pare for burning. He ploughed up an acre in the middle of the piece, and set it with early dung peas, which he got off in time to sow with cole-seed with the other; and he manured it with twelve loads of muck. The result has been, that the burnt part has been twice as good in every crop, and has now greatly the advantage in appearance.

And Mr. Ambrose, near Colchester, followed the subsequent mode on sandy warren and heath-land, in the year 1794. "He had twenty acres of warren heath allotted to him, being a part of 300 acres of new inclosure. It was called the warren part of the heath, and had not apparently, he says, been broke up since Noah's flood. There was a little poor and bad sort of grass growing upon it, but mostly covered with ling or heath, some brakes, a little furze, and white-thorn stubbs. He thought it might do to shift his South-down wether lambs upon it. He tried with them for nearly two years, and it did him but little good. He was determined to set it on fire in the summer of 1796, and burn the ling up, it was so thick; and, when very dry, by the assistance of the brakes, it burned very clean, and at little expense. It cost him three shillings an acre only, levelling the hills, stubbing the few furze and white-thorn roots. It was thus made fit for the plough. He then ploughed it about four inches deep. At Michaelmas 1796, he sowed it with rye, two bushels and one peck per acre, to stand for seed. He has

threshed and dressed rather better than forty quarters of it. He then ploughed the rye-stubble in quite flat, that it might rot the better in autumn; and then, in the next spring, he gave it three more close and deep ploughings, and sowed it with black oats, white Dutch-clover, and rye-grass. He had eight quarters, threshed and dressed, and a great deal of good feed for his sheep and lambs the next summer, and they did very well upon it. In the autumn and winter, he manured it with dung and fresh earth mixed together, twice stirred over. He laid on twenty-three horse cart-loads per acre. The Michaelmas 1799, he ploughed it up, and drilled in six pecks an acre of American red-wheat, and has had threshed and dressed, from off the twenty acres, fifty quarters of as good wheat as ever he saw. He ploughed the wheat-stubble in again last Michaelmas, and sowed it with rye, and now has as fine a plant as he can wish to see. He designed to have this fed off with his sheep this spring, and has fallowed it for turnips, but the price which rye bears will induce him to save it for seed. The soil of these twenty acres of warren heath is black, light, and sandy. It was scarcely worth any thing before it was broken up; and now, to let, it is well worth twenty shillings per acre per annum.

But notwithstanding the success of this trial, the writer's method of cropping does not seem to have been the best that might have been adopted. It is never proper to have recourse to successive crops of the grain kind.

The following mode of cropping land of the poor gravelly heath kind has been advised by Mr. Wright, of Rutlandshire, who properly objects to taking two corn-crops immediately after each other. "First year, pare and burn, and sow with turnips. Second year, barley; immediately after the barley-crop, on once ploughing, harrow in winter tares, to be mown for soiling stock of all kinds upon the same ground; the fence to be kept shifting back as the piece gets cleared. They may begin, he thinks, perhaps, the third week in May, and continue till the seed in the pod is nearly full, perhaps in the beginning of July; what is then unconsumed, should be mown and made into hay, which is excellent; then immediately on one ploughing sow with turnips without manure, though it would certainly be a valuable addition, if attainable; after turnips, barley, laid down with seeds, either for one year, or permanently."

It is observed, that in this management there are five valuable crops, and the land laid down with seeds, in three years and two months; and that all may be expected to be good ones, with either fallow or manure.

It is supposed, that, in this rotation, "land can get neither foul, stale, nor exhausted; tares are, he says, by many thought an inconsiderable crop: but these are such persons as have not been in the habit of cultivating them. All things considered, he thinks, it is a matter of doubt, whether a farmer can cultivate a more beneficial crop, from the ameliorating quality of smothering. Corn thrives remarkably kindly after them. Some may, he says, object to corn-crops coming so seldom: to this he answers, that the most corn sown, is not always the most reaped; but the very reverse, for these two corn-crops will, at a certainty, produce more corn, than if every crop had been of that description, whilst the land is left in an improved state, instead of being totally ruined."

On a poor heath, on a chalk bottom, the soil in some places white, and from three to six inches in depth, in some of of the hilly parts, the chalk-stones, being blended with the little soil there is quite to the surface; which, though better in colour, is bare, and produces little herbage. In other places, it is deeper, and of a red-sandy nature, producing various coarse plants, but of a better quality, both in its natural and cultivated state. Mr. Wedge had recourse to the following management:

"He began first with the best land before described, which he ploughed; and with a heavy roll he rolled it down very close, and some part he set with peas, and the other part with oats; after which crop he turned the furrows back without breaking them, run a drill over it, and sowed it with wheat. This answered very well, but best on the pea land: he then fallowed it for turnips, and found, and still finds, that turnips will not do very well in this course without muck. With the barley-crop, about a peck of trefoil, 3lbs. of red-clover, and a peck of rye-grass, were sown, and the land laid down for two years. When this piece was sown with wheat, he burnt a slip of it that he had left on purpose, and sowed it with wheat at the same time with the other. On this land the wheat was better than on the other, and the turnips better without muck; the barley and the seeds were also better. This encouraged him to go on, and he has found it right. It is much the practice to sow this sort of burnt land with turnips, and then with barley, and this is generally followed with two or three crops more before it is laid down. It certainly ought to be laid down with the barley-crop; and if it is good land, taken up merely for the purpose of improvement, to get it down again as soon as possible, the course will certainly succeed; but at the present moment this ought not to be done, because a certain crop of wheat will be lost. Nor does he think it either so beneficial for the land, or so profitable to the farmer, to take turnips first. These, says he, require the land to be in good tilth, which is seldom the case with one ploughing; and this is one reason why they so often fail; another reason is, that the land is generally ploughed as soon as the ashes are spread, whereby the ashes are all laid at the bottom of the furrow, which generally is about four inches deep, without being mixed with it; and being washed into the chalk with the first shower, a great deal of goodness is thereby lost. Of this fact he has had sufficient proof; all the middle parts of the summer of 1799, was extremely unfavourable for burning: he had, when the wet season set in, about ten acres burnt; the ashes were spread, lay all the summer, and were washed in by the rain till the land was

nearly grassed over. After the rains were passed, he burnt some more, and the ashes were ploughed in immediately before sowing; the wheat-crop from this land was not so good as the other by more than four bushels an acre. But to return: if a crop of turnips should be obtained, you have such part of the manure from the ashes as is not lost, and the manure from the turnips for one crop of barley. Such lands as are sown with wheat and turnips, must either have muck or the fold, or both, to produce the crops, which cannot be the case. On the contrary, if wheat is sown the first crop, the ashes make it certain, and turnips are much more certain after the wheat, than they are at first. By this means, both the wheat-crop and the barley-crop are manured, without either muck or fold (except folding off the turnips), which is bestowed on other lands, and is pushing improvement further than it can be done by any other means, when manure is not to be purchased.

"The course that he has pointed out, will more plainly appear by the following statement:

1800. Burnt wheat.
1801. Turnips.
1802. Barley.
1803. Seeds.
1804. Half seeds, half peas.
1805. Wheat after seeds and peas.
1806. Turnips manured.
1807. Barley.
1808. Seeds.
1809. Half peas, half seeds.

"By this course, half the second-year seeds will be sown with peas or tares alternately, the wheat-crops will always take the fold, and the turnip-land the muck, which, generally speaking, will always secure on white land a tolerable crop of turnips: the fold will not produce the same effect. He thinks that, "after this statement, it requires but little to be said, in order to prove the great advantage of burning this sort of land. The seventh year after burning is the first time that muck is at all required, as the land is, in no one part of this process, in a state of impoverishment," or deterioration.

These different statements show, in the most satisfactory manner, that a great deal in the culture of this description of lands depends upon having recourse to proper methods of management in the breaking up and cropping the ground afterwards. See *Paring* and *Burning*.

But another mode of improving land of this nature is explained below.

It has been stated by Mr. Kiddle, of Marsham, in the fourth volume of Communications to the Board of Agriculture, that a "heath was inclosed of a very inferior quality, which had never produced any thing but brakes and fern; such a soil as, in many parts of this kingdom, would be thought incapable of any improvement. On one part of this land was found a most valuable bed of marl, mixed with veins of clay, in colour white, but of a soft meliorating nature; the tenant, who was an active man, embraced the opportunity of improving his land with avidity; and, with all the assistance he could procure, immediately covered his part of it with sixty loads on an acre, in the winter season. The land had, in the summer and autumn preceding, been ploughed two or three times. It being in the vicinity of the city of Norwich, he was able to procure a sufficient quantity of muck to cover it, at about twelve loads on an acre, and he then sowed it with turnips. The summer and autumn being moist, the turnips were equal to any of the old inclosures adjoining; the crop of turnips was fed on the land; the succeeding year it was sown with oats, which were allowed to be equal to any in the neighbourhood. The tenants on the opposite side of the heath, having no other resource (not, he believes, taking the pains to try for it) than the marl, which they had used for their old inclosures, and which was of a chalky nature, manured their's with the usual quantity, of about twelve loads on an acre; but manured it with the same sort of muck, which was used on the other, and sowed it with turnips, which were fed off the land. The difference between the crops on these adjoining lands, with a similarity of soil, was astonishing; and, to those who saw them, and were strangers to their management, not to be accounted for; as the turnips and barley were not of half the value on the last as on the first, and every succeeding crop of the first exceeded the others. This, and many other instances, if rightly observed, show the strong necessity of procuring, if possible, clay or marl, of the clayey nature, for such soil, even if brought from a considerable distance, as the land is by such means rendered of double its value. But, if no such manure can be procured, and chalky marl offers itself, it must be used at all events; as, without a staple manure, such land will never admit of being converted into tillage with any advantage to the cultivator.

"Without clay or marl, the land of such quality acquires no firmness, and no turnips can be grown on them; as, in the early part of autumn, they will be subject to the "*anbury*," and, after being infected with it, they never make any progress in their growth, nor are of any use for the cattle, particularly those that are in a forward state."

In respect to the culture of waste heath lands, where the tenants have leases, and are not able or disposed to improve them, it has been suggested by Mr. Ritchie, that, as the principal charge is the expense of lime, "the proprietor should advance the amount to the tenant, interest free for three years; the proprietor to be reimbursed at the end of that period; the tenant in return to be bound not only to improve on a plan to be laid down by the proprietor, but also to be subjected to a certain mode of cropping, after the improvement is effected." He states, that there are "many thousands of acres of land of this description, worth from 1*s.* to 9*s.* per acre;—the average of which is 5*s.* per acre in the present unimproved state."

The following is an "experiment made in the improvement of a small field of very coarse land, in its original state, not worth the average rent stated

above. It was summer-fallowed, and limed, under every possible disadvantage with regard to economy in the expense.

" *Expenses incurred on the Improvement of five Acres of coarse Heath Land, with the Outlays and Returns of the four succeeding Crops.*

		£.	s.	d.
To ploughing 5 acres four times over, at 3*l*. per acre -	£15 0			
To harrowing ditto, and gathering and burning the heath roots, &c. - - - -	5 0			
To liming at 5*l*. per acre -	25 0			
To 35 bushels seed-oats, 3*s*.	5 5			
To 2 years rent, at 5*s*. -	2 10			
To interest of money, before any return - - - -	2 15			
To reaping in, gathering, and other incidental charges on the sale of the crop - -	5 0			
Outlay before a crop - -	£60 10			
First Crop's Produce.				
By 220 bushels oats, at 2*s*. 10*d*. -		31	3	4
To total outlay before a crop	£60 10			
By the return of first crop - -		31	3	4
Expenses incurred on Second Crop.				
To 150 loads of dung at 1*s*. 6*d*.	11 5			
To 3 ploughings, and harrowings	10 0			
To 100 bushels seed-potatoes	5 0			
To cutting, planting, and horse-hoeing - - - -	5 0			
To rent - - - - -	1 5			
To raising the crop, and other incidental charges - -	11 5			
Outlay on 1st and 2d crops	£104 5			
Second Crop's Produce.				
By 1600 bushels potatoes, at 1*s*. -		80	0	0
Expenses incurred on Third Crop.				
To ploughing and harrowing for bear or big - - - -	3 15			
To seed 21 bushels, 3*s*. 6*d*. -	3 17			
To 10 bushels rye-grass, rye-grass seed, and 50lbs. clover ditto - - - - -	3 15			
To rent and other expenses -	6 5			
To total expense incurred on the three crops - -	£ 121 17			
By total produce of two crops -		111	3	4
Third Crop's Produce.				
By 180 bushels of big or bear, 4*s*. -		36	0	0
Total produce		147	3	4
Total expense		121	17	0
Balance in favour of improvement		£25	6	4

		£.	s.	d.
Brought forward		25	6	4
Statement of the Fourth Crop.				
By 500 stones of hay, 26lbs. per stone, 1*s*. - - -	£26 0			
Expense of mowing, making, &c.	1 10			
		24	10	0
By hay-stubble, or after-growth -		2	12	6
		£52	8	10

" This statement shows, the writer says, 52*l*. 8*s*. 10*d*. of clear profit on the improvement, besides a moral certainty of this small field continuing worth 15*s*. per acre in pasture, being triple its original value. And, with regard to the reimbursement of the proprietor's loan for three years of 25*l*., it is observed, that " the accumulated interest for that period amounts to 3*l*. 18*s*. 9½*d*.; and this sum accumulating for the space of ten years more, which he shall suppose to be the medium of duration of all the present let tacks on such lands, will extend to the sum of 6*l*. 8*s*. 7½*d*.; now, reckoning this field to let at 15*s*. per acre on a new lease, the proprietor will receive 45*l*. per cent. for such outlay. Thus it will appear obvious, the writer thinks, that a process of this nature, and carried on to a considerable extent, will turn out far more lucrative to the proprietor than a new purchase, a much greater national benefit, and a very great *stimulus* to improvement."

HEATHER, a common name applied to heath. See *Heath*.

Heather-*Roof*, that sort of a roof of a building, which is covered with heath or heather, in the place of straw-thatch. It is stated in the Argyleshire Survey, that this sort of roofing is well suited to buildings of the farm kind, as it does with " ordinary timber, can be had for a trifle, lasts almost as long as slates, and gives less trouble in repairs. A heather roof well put on will, the writer says, last one hundred years, if the timber will last so long." And he adds, in a note, that, " of old, most of the churches in this county were covered with heather." And that heather roofs are frequent in the district of Cowal; and there are a few of them in Kintyre." He suggests, that, in the " great rage for destroying heath, it would be wise to save at least as much of the proper kind, as might be needed for thatching." It is considered as " astonishing, that, in a country in which heather abounds, those roofs are not more common. They are, he says, indeed heavier than straw roofs; but, by making them a little steeper, and placing the couples a little nearer, than in our ordinary roofs, the most of the weight will be thrown on the walls; which, if made as they ought to be, of stone and lime, will not feel the burden." See *Roof* and *Thatch*.

HECK, provincially a sort of half-door, or small door.

HEDGE, the name of a fence formed from some sort of plants, either in a living or a dead state. These sort of fences are, therefore, distinguished into

live and *dead hedges*; the former being constituted of some sort of living plants, mostly those of the white-thorn kind; but the latter wholly of dead materials, such as the more slender parts of thorn, hazel, and other woods, that have been cut down for the purpose. See *Fence*.

Mr. Donaldson considers hedges, formed of white-thorn, as not only the most common and most ornamental, but, in lands suited to their growth, the most useful; and, when properly planted, the least expensive of all sorts of fences. There are a great many different methods of planting and raising this sort of fence, as has been shown under that head; and it is obvious, that the modes must be different, according to the situation, exposure, and nature of the soil.

It is remarked by Mr. Parkinson, that "the lands in Ireland are chiefly enclosed by ditches, five or six feet wide, and nearly as deep, out of which all the earth is thrown on one side, making a bank. There are scarcely, he says, any quickset hedges; and where there are any, they are so ill-managed, as seldom to be higher than the bank; for having no guard but the bank, the young shoots are continually eaten off by the sheep or goats, which latter are numerous, and greater enemies to quick even than sheep. The quick is set in the bank; but, having such a quantity of earth lying on the roots, and so deep a ditch close to it, the moisture is drained from the roots, which makes the plants grow so very indifferently, that, even in their best state, they will not bear plashing; which greatly improves quick. Plashing, indeed, is seldom practised: on the contrary, a single branch is frequently cut off here and there with a saw; and branches that remain, by hanging over the young shoots, overpower them completely with the wet that continually drops from them. Besides, a branch of thorn cut off by a saw does not, he thinks, throw out such strong shoots as when chopped off with an axe. This is not peculiar to quick; the same is observable in other plants.

"The hedges he has seen in Ireland, that have been attempted to be plashed, are bent down without being chopped or nicked at the bottom. Some chop the hedge up, which is very much against the after-growth, for want of something to guard it; for, though the bank be made six or eight feet high from the bottom of the ditch, and three feet above the quick on the other side, it forms but an indifferent fence, better adapted to keep off cattle than sheep; for sheep, and especially young lambs, which are much greater enemies to quickset plants than old sheep, will crawl down the bank to get at them. In doing this, they are liable to tumble into the ditch; and, as the ditch is generally dry, in attempting to get to their dams again, they learn to leap so dexterously, that no fence can keep them in any pasture. He, however, concludes by observing, that, during the whole of his experience, he has found no fence so proper for all kinds of stock as quick-thorn hedges."

Hedge-*Fence*, that sort which consists of some kind of hedge. See *Fence*.

Hedge-*Row*, the direction or track of a hedge.

Hedge-*Row Timber*, that sort which is raised in hedge-rows. The practice of growing timber-trees in hedge-rows is not in general to be much recommended; but, in some cases, it may probably be had recourse to with profit and advantage. Hedge-rows, in many districts, contain great numbers of pollard trees, which are not only disgusting to the sight, but highly injurious to the fences, and ought never to be permitted by the proprietors of the lands. See *Timber* and *Pollards*.

HEDGING, the operation of making fences of this kind, which is a business, that should always be well performed, in order to afford a perfect security to the farmer; but which, in general, is too much neglected. The season for executing this sort of business is during the most part of the winter, as from November to the end of March; but on no account at a more early or later period; as, in the former case, it would be too soon for the work being well performed; and, in the latter, the plants would be endangered by the rising of the sap.

The hedges of farms should likewise be made complete as soon after the tenant enters upon them as possible, and afterwards divided in such a manner as to have a certain length or proportion done annually, as by such a plan they may be more conveniently kept in proper order.

The methods of performing thir sort of work must constantly depend on the state and nature of the hedge; by which the workman can only be directed. The farmer should, however, avoid dead-hedges as much as possible, as they are attended with an almost constant, and, in many cases, a very heavy, expense. The plashing of old thin hedges often answers well in keeping up, and lasting much longer than where much of the materials is in a dead state; besides being a much better fence against cattle. As soon as the repairs have been made, the ditches, where there are any, should be well scoured or cleared out; and all the faggot and other wood immediately brought away to be stacked up in some proper place at home. See *Fence*.

Under each proper month, directions will likewise be found for the business, which is necessary to be done in regard to this, as well as other sorts of farm-work.

HEE-*Grass*, a term sometimes provincially applied to the stumps or stubble of mown-grass.

HEEDER, provincially a male sheep. And the female is termed *sheeder*.

HEEL *of a Horse*, the lowest hind-part of the foot, comprehended between the quarters, and opposite to the toe. See *Foot*.

HEIRS, a term signifying young trees in coppices.

HELL-*Weed*, a term provincially applied to bindweed.

HELM, a term signifying a hovel. It is also sometimes applied to straw prepared for thatching.

HELVE, a word provincially applied to handles in general.

HEMP, a well-known plant of the herbaceous fibrous-rooted kind, having a strong thick stem or stalk, which rises to a great height in good soils,

and affords a rind or covering of a firm strong texture, which is of much value in the manufacture of the coarser sorts of cloth, ropes, and various kinds of cordage, as well as other articles. There are many other plants which afford a strong fibrous covering, but none that has been yet discovered that are equal to hemp in the construction of these different articles. It is singular, therefore, that its cultivation should be so greatly on the decline in this country, where it is so much in demand, and serves so many useful purposes.

As there is no proper encouragement held out for the growth of this sort of crop, the farmer should have regard to several different circumstances in beginning its culture; such as having a convenient market for the disposal of it; the being provided with a full quantity of suitable manure, in order to have full crops; the extent in which it will diminish other necessary crops of the green cattle kind; and that of its being a sort of plant that can contribute little or nothing to the increase of the dung-hill: the trouble and attention, which it requires in being brought to a proper state for the market, with other local matters, should be well weighed and considered before its introduction is finally determined upon.

In respect to the soils, which are most adapted to the mixing of hemp-crops, it is well known, that they are all those of the deep black putrid vegetable kind, which have a situation low, and somewhat inclined to moisture, as well as the deep mellow loamy or sandy sorts. But the quantity of produce is in general much greater on the former than the latter; though, according to some, of an inferior quality. But, notwithstanding, this useful crop may be grown with much success on lands of a less rich and fertile nature, by due care and attention in their culture, and the means of managing them. It is advised by Mr. Young, in his Calendar, that for this sort of crop the richest soil on the farm should be had: deep, moist, friable, putrid, and in the next place, if none of that description can be had, any deep, good sandy loam, worth 30*s.* or 40*s.* an acre. "Mellow rich clayey loams, he says, do well; and nothing better than old meadow land, no matter what the soil, turned down by the skim-coultered plough." And he further states, that, "about Diss in Norfolk, and the districts in that vicinity, they cultivate this crop on rich mellow loams on a clayey bottom, worth 25*s.* an acre, friable, mixed, working readily."

And in Suffolk, according to the Report of that district, they mostly grow it on what are termed *mixed land*; that is, sandy loam, moist and putrid, but without being stiff or tenacious; in fact, the best land the county affords; and it does well on old meadow and low bottoms near rivers. But, in the northern districts, they think hemp requires a free, deep, warm, fat soil, exposed to moderate air, at the same time sheltered from blasts of high wind. Ground lying upon the coast enriched with sea ware, though light, has been often proved to give good hemp-crops. In the county of Stafford, large crops of this sort are said to be grown on soils of the heathy kind.

With regard to the preparation of the land for the reception of this sort of crop, it should be reduced into a fine mellow state of soil, and be perfectly cleared from weeds, by repeated ploughing and harrowing. This sort of work after grain-crops is mostly accomplished by three ploughings, and as many harrowings; the first being given immediately after the preceding crop is removed, the second early in the spring, and the last or seed earth just before the sowing. Others, however, advise that the land should, from the preceding autumn to the time of sowing, have three or four ploughings; or two with sufficient scufflings, and be well harrowed down to a fine surface. It is stated, that in Suffolk the tillage consists in three earths, with harrowing to make the soil perfectly fine; and that it is laid flat, with as few furrows as possible. It has been well observed, that there are many crops for which tillage should be cautiously given, as the weeds that may be set a-growing will choak and get the better of various plants; but this is not the case with hemp, which is so predominant in its growth, that it kills or destroys all weeds.—In the ploughing before sowing, well rotted manure, in the proportion of about twenty, or good rich compost in the quantity of thirty-three, one-horse cart-loads, should be turned into the land, as without such dressings it is seldom that a good crop can be raised. In the above-mentioned county "they manure for it with great attention, so that it may be taken as a maxim, that hemp is not often sown without this preparation: of dung and moulds twenty-five three-horse loads per acre; of dung alone, sixteen loads. This is done directly after wheat-sowing is finished." In Scotland it is directed that the ground for this crop should be well manured with the best dung, and made fine by tillage in winter, ploughed deep immediately before sowing, and the top dressed with ashes, or the dung of horses, sheep, or pigeons. And in the Argyleshire Report it is remarked, that hemp, though it requires rich and strong land, it exhausts the ground so little, that for many years it may be raised on the same spot, if well manured. It is an excellent cleaner of the ground, and is said to have the property of preserving from insects any crop that is within a belt of it. And others contend, that, from being remarkable for feeding or ameliorating the soil and killing weeds, as well as growing perpetually upon the same ground, it seldom needs manuring or weeding after the first year.

It is suggested, that the utility of the surface of the ground being left as perfectly flat as possible in this culture is, that the moisture is more effectually preserved, and the support of the plants more fully secured in consequence of it.

In regard to the choice of seed, and the manner of putting this sort of crop into the ground, it has been stated, that, in the growth of hemp-crops, it is of much consequence to have fresh good seed, which may be known by its having considerable weight, and a high degree of brightness in the colour.

In respect to the quantity of seed, the proportion usually made use of is from two to three bushels, according to the natnre and quality of the land; but as crops of this sort are much hurt by the plants standing too near together, two bushels or two bushels and a half may be more proper. According to Mr. Young, the quantity varies from eleven to fourteen pecks. In the county of Suffolk, the quantity of seed is eleven pecks per acre, at the price of from one shilling to two shillings the peck, generally from sixteen to eighteen-pence. Much is brought from Downham and the fens; the seeded hemp is not so good by eighteen-pence or two shillings the stone. In Argyleshire they use from twelve to sixteen pecks to the acre, according to the quality of the soil. If sown in drills, much less will do.

In most cases, the sowing is performed in broadcast, being evenly distributed over the surface of the land, and lightly covered in by means of harrowing. Some, however, have recourse to the drill method, as promoting the early growth of the plants in a more effectual manner, especially in crops intended for seed. It is stated by Mr. Young, that he cannot, however, see any motive for drilling a plant which utterly destroys weeds, except one, that of burying the seed at an equal depth. Should any person be inclined to drill, the rows should, he says, be as near to each other as the shares of the drill can be set.

It may be observed, in respect to the time of sowing this sort of crop, that as the plant is tender in its early growth, the seed should not be put into the ground at so early a period as that it may be injured by the effects of frost, or so late as that the produce may be affected by it. The best period on the drier lands is, probably, as soon as possible after the frosts in April; but where the soil is of a more moist nature, it may be better to delay it to a later period; in all cases choosing, if possible, a season in which the land is neither too dry or too moist for the business. Early sowing is, however, to be had recourse to as much as possible; as, where this is the case, Mr. Donaldson thinks the crops by becoming more strong and vigorous in the early part of their growth, the hemp withstands the various operations that are afterwards performed upon it in a much better manner than would otherwise be the ease.

Hemp is a sort of crop that may be grown after almost every other kind, and very well on land broken up from sward, where that is properly performed by the skim-coulter plough; and it is frequently cultivated on the same piece of ground for a great number of years, without any other kind intervening. And this is the case in the Ukraine, as well as in Suffolk, and other hemp districts. In the Report of the last-named county, it is remarked to have been grown in succession for seventy years together; but in such cases manure must be applied with almost every crop, in pretty large proportion, to prevent the exhaustion that must otherwise take place. And it would seem, probably, that better crops may be raised by a more frequent change in the nature of the plants.

When the crop has been put in, the greatest care should always be taken to keep birds from devouring the seed, as they are extremely fond of it.

After the seed is sown, little attention is necessary to weeding and cleaning this sort of crop, as, from the tall growth and thick foliage of the plants, they soon cover the surface of the land, and prevent the rising of all sorts of weeds. Where put in by the drill, a hoeing or two may however be necessary in some cases.

In the cultivation of this crop, it is necessary that the field contain both *male* and *female*, or *femble* hemp-plants. It is the latter sort that affords the seed.

As soon as the crop is ripe, which is shown by its having a whitish yellow colour, and the leaves beginning to fall from the stems, it should be *pulled*.

It is remarked in the Argyleshire Report, that it is later than flax in ripening, and grows in *male* and *female* plants, as just noticed, of which the former produces only flowers, and the latter seeds. And that the male kind ripens four or five weeks before the female. The female is ripe when the flowers fade and the stalk turns yellow, and the male when the stems become pale. That both are less injured by being pulled too soon than too late. When the one is pulled, care must be taken that as little injury as possible may be done to the other. If the ground is formed into drills or narrow ridges, there will be no danger of hurting it, as the intervals will afford room for the pullers.

It is however stated in the Farmer's Calendar, that, in Suffolk, the male and female hemp are pulled together; indeed, when the crop is thick, it is impossible to separate them; but that, in the fens, the male and female, or femble and seed hemp, are frequently separated. This may, the author supposes, arise from their hemp being coarser, and the stalks larger. And it has been remarked, by Mr. Donaldson, that the last is the better practice, as, by pulling a large proportion of the crop before it is in a proper state of maturity, the quantity of the produce must not only be considerably lessened, but its quality greatly injured, by being rendered less durable. The operation by which this is effected, is that of taking it from the ground, by pulling it up by the roots in small parcels at a time, by the hand; taking care to shake off the mould well from them, before the handfuls are laid down. It is usually done, about thirteen or fourteen weeks after sowing, and the expense varies considerably in different situations; in some it amounts to eighteen or twenty shillings, while, in others, it is equally well performed for eleven or twelve. After being pulled, it is tied up in small parcels, or what are termed *baits*, in some places.

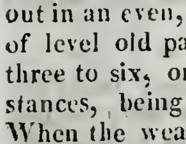
But where crops of this kind are intended for seeding, they are of course to stand till the seed becomes in a perfect state of maturity, which is easily known by its appearance. The stems or stalks are then pulled and bound up into bundles, being set up in the same manner as grain, until the seed becomes so dry and firm as to shed freely; it is

then either directly threshed out upon large cloths, spread for the purpose in the field, or preserved, to have it done at some future period when more convenient.

In the execution of this sort of business, great care should be taken at pulling, not to shake the stalks rashly, otherwise much of the seed may be lost. It is advised, that, after pulling the seed, hemp may be set to stand in shocks of five sheaves to dry the seed; but, in order to prevent any delay in watering, the seed-pods may be cut off with a chopping-knife, and dried on canvass exposed to the air, under some shed or cover. This last method of drying the seed will prove of great advantage to the hemp, as the seed and pods, when green, are of such a gummy nature, that the stems might suffer much by sun-burning or rain; which will discolour and injure the hemp before the seed can be sufficiently dried upon the stalks. Besides, the threshing-out the seed would damage the hemp in a considerable degree.

In the preparation of hemp, for the uses of the manufacturer, there are two modes in use, which are termed *dew-retting* and *water-retting*; the latter affords finer hemp than the former: in some situations, the former is seldom finer than two shillings the yard, while water-retted is five shillings. They are both best performed in showery weather. In the first the hemp, after being pulled, is directly spread out in an even, regular, and thin manner, on a piece of level old pasture, on which it is to remain from three to six, or more, weeks, according to circumstances, being occasionally turned during the time. When the weather is showery, this is mostly done three times in the week; but, in other cases, twice is commonly sufficient. When the rind or hempy substance becomes easily separable from the woody part or stem, it is taken up and tied into bundles, either to be stacked upon the spot, or carried home and placed in some convenient situation, where it may remain until wanted for use. In this business, which is termed *grassing*, great nicety is requisite, to prevent the texture of the hemp from being injured, by its remaining too long on the sward, or not being sufficiently long to render the hempy material readily separable.

But in the latter mode, which is more general and expeditious, when the hemp is all taken up, and bound in small bundles with bands at each end, to such a bigness as can be grasped with both hands, it is conveyed to a pond of standing water (if a clay-pit, the better), where it is laid, bundle upon bundle, direct and across thus,



which is termed a bed of hemp; and after it is piled to such a thickness as to answer the depth of the water, which some think cannot be too deep, though the usual depth does not exceed five or six feet, it is loaded with blocks and logs of wood, until all of it is totally immersed: after remaining in this state four or five days, as the weather shall direct, it is taken out and carried to a mown grass-field, or any other grass-land that is clean and free from stock: the bundles being untied, it is spread out thin, stalk by stalk: in this state it must be turned every other day, especially in moist weather, lest the worms should injure it. Thus it remains for six weeks or more; then it is gathered together, tied in large bundles, and kept dry in a house or stack, till wanted for use. It is stated, that, in the northern parts of Scotland, after the hemp is pulled, and the leaves, seeds, and branches, taken off with a ripple, it is made into bundles of twelve handfuls each, and steeped as flax from six to eight days. It is known to have enough of the water, by the reed separating easily from the bark. It is better the time should be too long than too short. The slenderest requires the longest time. When the quantity is small, the bark may be separated from the reed, by pulling out the reed from every stalk by the hand; when large, by drying and breaking it like flax. It is not spread on the ground there like flax, but dried immediately, by setting it leaning against ropes tied to trees or poles; or any other way that will give it all the advantage of the air, till it is thoroughly dry and blistered from the boon. After it is reeded, it must be freed from the mucilaginous matter, by pouring water upon it, and squeezing it several times, taking care not to let the threads entangle in each other, as this produces waste.

It is stated by Mr. Young, that Mr. Rainbeard, of Norfolk, in the watering of hemp, "has a contrivance, by means of which it is deposited in the pit, without the necessity of a single person being wet. The pond is an old marl-pit, with a regular slope from one side (where the hemp is prepared), to the depth of eight feet on the other side: on the slope above the water, the hemp is built into a square stack, upon a frame of timber of such a height, as will float and bear a man without wetting his feet: this is slid down upon the frame into the water, and, when floating, drawn away; a person on the opposite bank drawing the floating stack to the spot where it is to be sunk, and on which it is built to the requisite weight. He finds it does soonest at bottom, and would not object to sixteen feet of water. By means of this very useful contrivance, he can put in a waggon-load in an hour. The sheaves are taken out in the common manner, sheaf by sheaf; but here," Mr. Young says, "a further improvement is wanted," which may, probably, be effected by some simple contrivance, on the principle of the lever, or some other equally easy to apply.

On the Continent, a new process for steeping hemp has been suggested by Mons. Brealle, the utility of which has been confirmed, it is said, by numerous experiments. It consists in heating water in a vessel or vat, to the temperature of from 72 to 75 degrees of Reaumur, dissolving in it a quantity of green soap, in the same proportion to the hemp as 1 to 48. The water employed for this purpose, should be about 40 times the weight of the hemp. Then throw the latter into the water, so as to float on the surface, covering the vessel, and extinguishing the fire. Let the hemp remain in this situation two

hours, when it will be found to be sufficiently steeped. The advantages derived from this method are various: independent of the saving of time and expense, the same quantity of hemp yields more tow. This new method likewise tends, it is said, to encourage the culture of hemp, by facilitating its preparation, even to those who do not live in the neighbourhood of a river, stream, or pond; and it obviates the ill consequences that might result, either from the infection of the air, or the corruption of the waters, which sometimes destroy all the fish they contain, and must of course prove highly injurious to the cattle that chance to drink of such waters.

It is observed, that, in many places, the hemp left for seed is not water-retted, on account of the additional trouble and expense, though it would be better to have it done. It is mostly stacked and covered during the winter, and spread upon meadow-land about January or February: if in the time of snow, the better it will come to a good colour, and make strong coarse cloths; but it is much inferior to hemp pulled in proper time, and water-retted.

The business of preparing hemp for the *heckle* is mostly accomplished by the beetle, and by having recourse first to coarse, and then to a finer break. It may also be done by the rollers of a lint-mill, shaking the handfuls frequently and smartly, either of which methods will answer, when the hemp is properly watered; when that happens not to be the case, it is often, indeed, necessary to *peel* off the rind from the boon with the hand.

Other methods have likewise been employed for this purpose.

It has been observed, that, of these different ways, the last is more expeditious and less laborious than either of the other ways; but is dangerous to the workmen employed therein, because, if by any inadvertency the rollers should catch hold of their fingers, the loss of a limb at least is inevitable. The only means of preventing this dreadful consequence, in such a case, is, to have an iron crow at hand ready to clap instantly between the rollers, as is practised in sugar-works, the mills in which are of a similar construction. The fluted rollers are undoubtedly the best instrument for breaking hemp, because the length of the stalk, and strength of the reed of this plant, must render the Dutch-break a very tedious operation, especially when large quantities of hemp are raised; as must be the case wherever a sufficiency of it is cultivated to answer the purposes of the great and important manufactures in which it is employed. The hemp-mill, used in America, is also a good instrument. It consists of a large heavy stone, shaped like a sugar-loaf, with the small end cut off. A body of that form will go round in a circle, if it be moved on a plane. This is moved by a water-mill; and the hemp, being laid on the floor, in its way, is bruised by the weight of the stone passing over it.

After the hemp has been broken, it undergoes a second operation, which is commonly termed swingling or scutching. The intention here is, to separate the reed from the hemp, and this is done by one or other of the following ways. In the first, the workman takes a handful of hemp in his left hand, and, holding it over the edge of a board, strikes it with the sharpened edge of a long, flat, and straight piece of wood, commonly called a swingle-hand or scutcher. But, as this method is very laborious and tedious, water-mills have been erected, in which several scutches, fixed in the same axle-tree, are moved with great velocity. Here the work is performed with great expedition, and much less fatigue to the workmen; but a greater waste is made of the hemp, owing to the velocity with which this engine is turned. And before the hemp thus prepared is heckled, it usually undergoes a third operation, called beetling; the design of which is, to loosen, and thereby more thoroughly separate its fibres. The beetles used for this purpose are moved either by hand or by water. See *Flax-Dressing*.

Steeping again has been advised, by some, for effecting this last purpose. But when proper care is taken in the other processes, it will seldom be necessary.

In regard to the produce of crops of this sort, it is obvious, that the quantity must be liable to vary, according to the nature of the land, and the culture employed. In the county of Suffolk, it often rises to forty-five and fifty, or more, stones on an acre; but, in other districts, it does not sometimes exceed twenty-five.

It is stated by Mr. Donaldson, that the average of crops of this sort, when made ready for the heckle, are from thirty-eight to forty stones, of fourteen pounds each. The price is generally from about seven shillings and six-pence to eight or nine shillings the stone, exclusive of the bounty allowed by government, which often amounts to fifteen or twenty shillings the acre more. It is stated, that, in Norfolk, an average crop is about forty stones, at present about twelve shillings a stone, water-retted; dew-retted, nine shillings. The common price of seven years, six shillings dew; and water-retted, eight shillings. In Scotland, the produce of an acre of hemp, when it grows well, may be reckoned about forty stone, and the price, from ten to twelve shillings. In hemp standing for seed, the usual proportion is from about eleven to twelve bushels the acre, the price being mostly from four to six shillings the bushel.

From what has been stated, it is sufficiently plain, that, from crops of this nature requiring the most rich sorts of soil, large supplies of manure, and much labour and trouble in the different processes through which they pass, that the expenses must be considerable. The value of the crops, however, in general, repay the farmer very well. These expenses are shewn, with the amount of produce or profit, in different districts and counties, in the statements introduced below.

The writer of the Agricultural Survey of the County of Norfolk states, that, in different parts that district, they stand in the following manner:

Account seven miles round Diss, Lopham, &c.

EXPENSES.

	£.	s.	d.
Rent	2	0	0
Tithe	0	5	0
Rates	0	5	0
Ten pecks of seed, at 1*s.* 6*d.*	0	15	0
Sowing	0	0	6
Three earths	0	12	0
Five harrowings	0	2	6
Ten loads of farm-yard dung	2	0	0
	6	0	0

On an average, sells as it stands.

	£.	s.	d.
Hemp, selling from the break, at 6*s.* 6*d.* for	8	8	0
Expenses	6	0	0
Profit	2	8	0

Suppose the crop 40 stone, dew-retted:

	£.	s.	d.
Pulling and spreading, turning and tying	1	5	0
Breaking, 1*s.* 3*d.* a stone	2	10	0
	9	15	0

	£.	s.	d.
Forty stone, at 6*s.* 6*d.*	12	10	0
Expenses	9	15	0
Profit	2	15	0

About the former of the above places, where the culture is much affected by the high price of wheat and turnip-seed, the cottagers sowing turnips on their hemp grounds, and when the seed is high, letting them stand for seeding, the following is the statement:

Account of an Acre.

	£.	s.	d.
Rent, tithe, and rates	3	0	0
Manuring 20 loads	5	0	0
Five earths	1	5	0
Harrowing	0	2	6
Seed, 10 pecks, at 2*s.*	1	0	0
Pulling	0	15	0
Dew-retting, spreading 2*s.* 6*d.* turning 4*s.* 6*d.* getting 5*s.*	0	12	0
Breaking 40 stone, at 14lb. 1*s.* 6*d.*	3	0	0
	14	14	6

	£.	s.	d.
Value then, 8*s.* 6*d.* a stone	17	0	0
Expenses	14	14	0
Profit	2	5	0

	£.	s.	d.
Bunching and heckling, at 1*s.* 6*d.* on 40 stone	3	0	0
	17	14	6

	£.	s.	d.
Bought forward	17	14	6

	£.	s.	d.
Value then, 40 stone, at 10*s.* 6*d.*	21	0	0
Expenses	17	4	6
Profit	3	5	6

	£.	s.	d.
Spinning 10 clews, at 8*d.* per stone, 6*s.* 8*d.*	13	6	8
Half bleaching 40 stone, at 2*s.* 1*d.* (chiefly labour)	4	6	8
Winding on bobbins, 40 stone	1	0	0
Weaving, 40 stone	8	0	0
Bleaching the cloth (nearly all labour)	3	6	8
Total culture and manufacture of every acre	47	14	6

After another crop on a layer, about Fritton, Bessingham, Palgrave, &c. it is stated to stand thus:

Expenses on an Acre.

	£.	s.	d.
Rent, tithes, and rates	2	0	0
Seed, 13 pecks, at 2*s.*	1	6	0
Manure	5	0	0
Three earths	0	15	0
Harrow and sow	0	5	0
Pulling, retting, spreading, lifting, turning, binding, and housing	3	0	0
Breaking, 40 stone, at 1*s.* 6*d.*	3	0	0
At 7*s.* 6*d.* it only pays	15	6	0

But about Hoxne, in the county of Suffolk, according to the Survey of that district, the expenses and profits of an acre were found to stand thus:

EXPENSES.

	£.	s.	d.
Rent, tithes, and rates	1	10	0
Manure, 25 loads, at 1*s.* 6*d.*	1	17	6
Three earths, at 4*d.* harrow included	0	12	0
Seed	0	16	6
Sowing	0	0	6
Pulling	0	12	10
Watering	0	12	0
Grassing	0	10	0
Breaking	2	12	6
Carriage and delivery	0	5	0
	9	8	10

PRODUCE.

	£.	s.	d.
Forty-five stone, at 7*s.* 6*d.*	16	17	6
Expenses	9	8	10
Profit	7	8	8

However, about Beccles, where another mode of calculation is had recourse to, and rent *valued*, they stand in the following manner:

EXPENSE.

	£.	s.	d.
Rent, tithes, and rates - -	4	0	0
Manure - - -	3	0	0
Tillage - - -	1	4	0
Seed, 12 pecks - -	1	16	0
Pulling - - -	0	19	0
Watering - - -	0	12	0
Grassing - - -	0	10	0
Breaking - - -	2	10	0
	14	11	0

PRODUCE.

Fifty stone, at 8*s*. - -	20	0	0
Expenses - - -	14	11	0
Profit - -	5	9	0

In the estimate of the Rev. Mr. Mills, as given in the same work, they are these:

Expenses on one Acre.

	£.	s.	d.
Rent of an acre of land -	1	0	0
Ploughing, sowing, &c. -	0	10	6
Three bushels and a half of seed, (sold from 1*s*. 4*d*. to 2*s*. 6*d*. per peck) at 1*s*. 6*d*. per peck -	1	1	0
Boy keeping birds a week or more	0	1	6
Pulling at the rate of 1*s*. per week, according to the seed sown	0	14	0
Getting it in and out of water, turning and laying up - -	1	1	0
Tithe and rates, suppose -	0	6	0
The lowest crop is 48 stone per acre, let us suppose only 40, breaking at 1*s*. 3*d*. - - -	2	10	0
	7	4	0

PRODUCE.

Forty stone at 7*s*. -	14	0	0
Parliamentary bounty, 3*d*. a stone	0	10	0
	14	10	0
Expenses - - -	7	4	0
Neat profit per acre - -	7	6	0

It is stated, that, in Lincolnshire, when *plaited* in bundles, the hemp is sold at 5*s*. to 7*s*. 6*d*. per stone, but has been known within ten years at 2*s*. 6*d*. and 3*s*. 6*d*. In 1795 and 1796 from 5*s*. to 7*s*.; 45 stone an average crop, 50 very good.

Account for an Acre.

				£.	s.	d.
Three ploughings and harrowings				0	15	0
Seed - - -				0	15	0
Sowing - - -				0	0	6
Pulling by the hundred (120) 1100, 1*s*. 6*d*. - - -				0	16	6
Knooking and burning, 6*d*. a hundred - - -				0	5	6
If tied five in one, it is 2*s*. per hundred; or 6*d*. single tying at the root end, as well as at the top				0	1	10
Watering, casting - -				0	5	6
Spreading, two women -				0	2	6
Putting in - - -				0	2	0
Taking off sods, and taking out -				0	2	6
Carting - - -				0	5	0
Twice turning - -				0	3	0
Gathering - - -				0	3	0
Carting to barn - -				0	4	0
Breaking 45 stone - -				2	5	0
Carrying out, 1*d*. a stone -				0	3	9
Rent - -	£1	10	0			
No tithe; poor rates -	0	5	0			
Drainage tax -	0	2	0			
				1	17	0
				8	9	7

The estimate of the expense and profit of an acre of hemp is stated to be this in Scotland:

	£.	s.	d.
Rent, suppose per acre - -	3	0	0
Manure, the first year more than others; but it is most advantageous to sow after a turnip-crop, say 40*s*.	2	0	0
Three times ploughing and harrowing	0	18	0
Seed, suppose 4 or 5 pecks -	0	10	0
Pulling the female hemp, and trimming - - - - -	0	10	6
Cutting the male hemp, and trimming for putting in water - -	0	7	0
Getting from the reed, and washing the female hemp - -	0	13	6
Getting the male from the reed, and washing - - - -	1	0	0
Soap - - - - -	0	2	6
Threshing seed - -	0	2	6
Total supposed expense	9	4	0

PRODUCE.

Female hemp, suppose 125lb. at 1*s*. per lb. - - -	6	5	0
Seed, suppose 20 pecks, at 2*s*. 3*d*.	2	5	0
Male hemp, suppose 375lb. at 7½ per lb. - - -	11	14	0
Faggots - - - -	1	0	0
Total, supposed produce -	21	4	0
Total, supposed expense -	9	4	0
Total profit	12	0	0

It is stated in the Agricultural Survey of the county of Norfolk, lately published, that

A good spinner earns 8*d*. a day
A middling one 6*d*. a day
A bad one, or child 4*d*. a day
The weavers 7*s*. to 14*s*. a week
Women ditto, 10*s*. or 12*s*.

And that the price of hemp, from the break, was, in

1789 Hemp bought at 5*s*. per stone.
1790 Ditto, 5*s*. 6*d*.
1791 Hemp bought at 5*s*. per stone, per acre

		£.	s.	d.
1792	Ditto, — —	4	15	0
1793	Ditto, — —.	6	0	0
1794	Ditto, 7*s*. 6*d*.	6	6	0
1795	Ditto, 7*s*.	7	7	0
1796	Ditto, 6*s*. 6*d*.	7	7	0
1797	Ditto, 7*s*.	7	7	0
1798	Ditto, 6*s*.	6	6	0
1799	Ditto, 6*s*.	7	0	0
1800	Ditto, 8*s*.	9	9	0

The writer of the Argyleshire Report thinks, that this will prove a profitable crop to the farmer, who has greatly the advantage over the importer of foreign hemp, which, over and above freight and risk, is liable to a heavy duty, namely, 2*l*. 4*s*. per cwt. when dressed, and for undressed 3*l*. But the principal advantage of this crop is, that, like flax, he conceives, it is capable of being brought to many times the value of the original raw material. It is spun into clews of 4,800 yards, and pays about the twentieth part for bleaching. The price of the clew depends upon its fineness. At one clew from the pound it is 7*d*. one-half 8*d*. two 9*d*. two one-half 10*d*. and three clews 12*d*. each. A spinner will earn 6*d*. a day with ease, spinning two-thirds of a clew, and a weaver may earn from 10*s*. to 15*s*. a week. The finer yarn is made into cloth for shirts and sheets, worth from 3*s*. to 4*s*. the yard; and lasts twice as long as that which is made of flax.

It is obvious from these estimates, that though the expenses of cultivating this article are very considerable, in many cases, the value of the produce amply repays them; of course, that it is a sort of crop that the farmer might look to with confidence for profit, if a proper stimulus to its introduction was but afforded. And that this, under the present circumstances of the country, is highly necessary to be done, cannot be disputed.

It has been observed, by Mr. Donaldson, that the most advantageous period for the farmer to dispose of crops of this sort is, while they remain upon the ground, just before the season of pulling them; as, by this means, he avoids the trouble and uncertain expense of the different operations, which are requisite in their preparation for the market, and which are so liable to interrupt his other work.

On the whole, it cannot, therefore, be doubted, but that, in many situations, hemp might be cultivated with great profit, and that it would be of vast national benefit to have its growth extended to a much greater degree than at present; but this cannot take place while the price of wheat is at its present height, unless due encouragement was given by the legislature. If that was the case, as it affords an excellent preparation for wheat, it would, in all probability, be much had recourse to, especially if such encouragement was held out for any suitable length of time. In those situations where its culture is the most extensively practised, it is confessedly of great advantage to the poor, in affording them much employment. And it has been suggested, in the above Survey, that it would be of great utility to encourage the growth in all places where there is much need of sail-cloth, cordage, and netting; to keep the money that goes for these articles in the country, and to give employment to the poor. A plan for the effecting of this purpose has been suggested by Mr. Young, and described in his able Survey of the County of Norfolk.

HEN, the female of the gallinaceous tribe of birds. It is an useful sort of domestic bird in the farm-yard, both in supplying eggs and chickens. In order to render them productive in the former, hens should be well kept with grain or some other sort of seeds. Those of buck-wheat and hemp have been much recommended by some writers. See *Poultry*.

HEPS, the fruit of a species of wild rose, generally written *hips*.

HERB, a term applied to a plant, whose stem perishes annually. It is that part of a vegetable which arises from the root, and is terminated by the fructification, comprehending, 1. The trunk, which serves to multiply the herb, and leads immediately from the root to the fructification: it is clothed with the leaves, and terminated by the fructification. 2. The leaves, whose office is to transpire and attract, like the lungs in animals, and to afford shade. 3. The fulcra, or props, which serve as stays to strengthen the plant; but may, however, be taken off without destroying it. 4. The hybernacula, winterings, or the bulbs and buds, each of which is a compendium of the herb upon its root before it begins to grow.

HERBAGE, a term usually applied to grass; as pasture in general. It is also used to signify the tithe and right of pasture. See *Grass*.

HERBER, in *farriery*, a term used formerly to denote an application used in some diseases in horses, particularly those of the head, and consisted only of a piece of hellebore-root, which, being put into the skin, acted as a rowel or seton.

HERD, a term signifying a number of beasts together, generally black cattle, and swine.

HERDSMAN, a word used to signify a keeper of herds; one employed in tending cattle.

HERMAPHRODITE, in *farriery*, a term generally understood to signify an animal exhibiting a confusion of the sexes, by a participation of the genital parts of both. The existence of these has been doubted by some, but, probably, without sufficient reason.

It has been observed by Mr. Hunter, that the *free-martin* is an undoubted hermaphrodite pro-

duction; and of which he has given a most ingenious account in different papers read before the Royal Society. It is also sometimes applied to a large sort of waggon.

HERMAPHRODITE-*Flowers*, those which contain both antheræ and stigma, which are the male and female parts of generation.

HERNIA, in *farriery*, a name applied to a rupture, which is caused by some sudden effort, by which part of the abdominal contents are forced through the interstices left between the tendinous expansion of the abdominal muscles for the passage of nerves and blood-vessels, or of some other part, and a tumour is formed, which, from its resemblance to the pushing forth of a branch, has been called a *hernia*. And there are different kinds of hernia, named from their nature and situation. See *Rupture*.

HERRING-*Scales*, the refuse of herrings, collected at the places where that sort of fish is cured. They are found to be useful as a manure. It has been observed in the third volume of the Annals of Agriculture, that, "besides other kinds of manure, the Lestoff farmers use herring-scales. The herrings are washed in large tubs, previously to their being smoked, and what scales come off in the operation are sold to the farmers, at 6*d.* the last; that is, the scales of 10,000 herrings.

"These scales are sown upon wheat on clover lays, and harrowed in with the corn; and from such treatment the crops are thought to receive considerable advantage.

"And might not then, it is asked, from the same source, an additional benefit be derived? the water in which the herrings have been washed is oily, bloody, and strongly impregnated with the effluvia of the fish. Now this water might be received into reservoirs contrived at no very great expense: from these it might, as occasion served, be drawn and conveyed in watering-carts (such as are in use about London to water the roads) either immediately to the fields that are in a proper state to receive it, or to a heap of sods intended for compost. Sods for this purpose are preferable to dung, either rotten or fresh; for they will absorb the moisture, whereas rotten dung is too compact to admit it, and too rich to want it; as for that which is not yet rotten, much wet prevents the process of the fermentation, which is necessary to convert it into manure.

"The probability of any good arising from the use of such water is grounded, the writer confesses, upon nothing but that of the scales above-mentioned; yet if, upon the authority of the Lestoff farmers, we admit the utility of the practice, the presumption is very much in the favour of the hint, which is here submitted to the consideration of the experimental farmer living in the vicinity of a fishing town.

"Before any great expense is incurred, let a small open spot of ground, of equal goodness throughout, be appropriated to the trial; of which, if one half receives a common dressing, and the other this alone from a watering-pot, the produce of each will decide upon the respective merits of the two modes, and plainly evince what degree of attention is due to the latter." Other sorts of refuse of fish might probably be made use of with advantage.

HIDE, the skin of a beast; but more particularly applied to those of large cattle, as bullocks, cows, horses, &c.

HIDE *of Land*, such a quantity of land as could be ploughed with one plough within the compass of a year, or so much as would maintain a family: some call it sixty, some eighty, and some an hundred acres.

The distribution of the kingdom by hides of land is very ancient; mention being made of it in the laws of king Ina. Henry I. had three shillings for every hide of land, in order to raise a dowry for his daughter: this tax was called *hidage*.

HIDE-*Bound*, in *farriery*, a diseased state of horses, and other animals, in which the skin sticks so fast to the back and ribs, that the hand cannot separate the one from the other, without great difficulty. In the horse, the body is at the same time lean, the back-bones standing up, the guts for the most part deficient in moisture, and the dung dry, and more offensive than common.

Where a horse becomes hide-bound by hard riding and ill keeping, he may be cured by good keeping. But if it be the effect of a fever, or some other disease, if that be cured which is the cause, the effect will cease. It is of course not to be accounted an original disease, but only a symptom, which may either be caused by want of sufficient food, or from harassing horses beyond their strength, without allowing them sufficient time for rest and necessary refreshment. Sometimes horses grow hide-bound very suddenly, from fevers and convulsive disorders; and, if that symptom is not suddenly removed, the disorders that occasion it generally prove mortal; but nothing is more common than to see surfeited horses also hide-bound; and therefore, in the cure of all hide-bound horses, regard must be had to the original cause from whence it proceeds.

The diet of hide-bound horses should be cool and opening, as scalded bran or barley; and Gibson recommends, that an ounce of fenugreek seeds should be given in his feeds for a month, or longer. As this often also proceeds from worms, it may be necessary to give the medicines common in those cases. See *Worms*.

And Taplin recommends in the cure, to take away a small quantity of blood, and in three or four hours after increase its impetus by a mash of malt, oats, and bran, equal parts; continuing it every night for a fortnight, stirring in two ounces of flour of brimstone every other night; giving the horse his other feeds morning and noon, equal parts of oats and bran, with half a pint of old beans in each, to prevent relaxing the body too much by the mashes. This treatment may often be useful when the first part of it or the bleeding is omitted.

HIGHLANDERS, a term provincially applied to the highland breed of Scotch cattle.

HIKE, provincially to strike with the horn, as cattle.

HILDER, provincially the elder tree.

HILL, an elevation of ground less than a mountain; a down.

HILLOCK, a term applied to a little hill.

HILLOCKY, provincially full of ant-hills.

HILLY-*Land*, such land as is much raised into hills. This sort of ground is more troublesome in its tillage than that of the more level kind. See *Tillage*.

HIP, a part of an animal. See *Haunch*.

HIP-*Shot*, in *farriery*, the state, in which the hip-bone is removed out of its place: this happens to the horse many ways; as by a wrench, stroke, or slip, strain, sliding, or falling. And the signs by which it is known are, that the horse will halt much, and go sideling, and draw his legs after him, the hip will fall lower than the other; in time, the flesh will also consume away; so that if it be let alone too long, it can never be cured.

HIPPLE, a sort of cocklet or small cock of hay.

HIRSEL, a term used in the northern districts, to signify a division of sheep into particular kinds.

HIVE, a well-known contrivance for containing bees. They are of many different sorts; but those formed of straw are probably the best. See *Bee*.

HIVING *of Bees*, the act of placing a swarm of bees in a hive, in order to have the benefit of their labours. See *Bee*.

HOBBY, provincially used to signify a hack or small road-horse.

HOCK, in *farriery*, a part of an animal, which, especially in the horse, is liable to hurts and strains; many of which are easily cured when taken in time, though they have been very much swelled, only with the use of cooling remedies; however, when the ligaments are hurt, the cure becomes difficult. The surest way in this case, according to Gibson, where there is great pain and weakness, is to ply the part well with fomentations. If the callosity or hardness grows only on the outside, it may be effectually removed by repeated blistering, and without any hazard; but if it is upon the inside, it may be out of the reach of outward applications: the best remedy in this case is, firing the part very gently with small razes or lines, and pretty close together; after which the following charge may be applied:

> Take of mercurial plaister, four ounces; hemlock plaister, with ammoniac, two ounces: Let these be melted together, and applied over the hock, renewing it once or twice, as it crumbles off.

Sometimes the disorders of the hocks produce the sallenders. See *Sallenders*.

HOE, a well-known implement of the tillage kind, constructed in various forms and methods, according to the purposes for which it is intended. Hoes are distinguished into different kinds, from the differences in the manner and powers by which they are wrought; thus we have *hand* and *horse-hoes*, or such as are employed by human labour, and by that of the horse. The former is mostly made use of where the crops are raised in the broad-cast or narrow row methods, while the latter is had recourse to in such drilled crops as have large intervals, and regular rows.

Hand-HOE, a sort of tool, of which there are many different sorts. The common square hand-hoe is well known, and made much use of for many different purposes, such as hoeing and thinning, or setting out turnips and other similar crops sown in broad-cast; as well as for thinning the plants in those that are raised in rows. It is usually formed of a square piece of iron, with an eye in the middle, for the reception of a handle; but sometimes they have a sort of hoop from each extremity of the square part, to the middle of which the handle is fastened. This is considered as an improvement, from the earth or mould being let through the bowed part.

They are also of different sizes or dimensions, for different sorts of crops and lands; but the following are those most generally employed:

2-inch hoes	8-inch hoes
3-inch do.	9-inch do.
4-inch do.	10-inch do.
5-inch do.	12-inch do.

Those of the two first sorts are used for various sorts of crops in their more early growth, as wheat, parsnips, carrots, &c. And the four-inch sorts are likewise used for these; and also sometimes for the first hoeings of turnip-crops; as well as different seed products.

The eight and nine-inch kinds are employed for the late turnip-crops, and those of the pea and bean kinds, and on most descriptions of land.

The two last sorts are made use of on the sandy and loamy soils, that are free from stones; as well as on flinty soils, for the early turnip-crops.

But, as answering the purpose of thinning out the plants that stand in a very close manner, in different sorts of crops more effectually, a *triangular hand-hoe* has been constructed, which is represented at *fig.* 8. in *pl.* LII. In this hoe, one of the points of the angles is placed downwards, by which it cuts the plants out to much exactness.

And another *hand-hoe*, which has two points, that cut and divide the soil, has been found very effective for many purposes. It is shown at *fig.* 9. in the same plate. It has been observed by Lord Somerville, that this tool is much used in Portugal; and that, by its weight and conical form, and its handle being light and short, it is found to execute its work to a good depth, without any extraordinary exertion in the labourer. They there employ it in breaking up the strong lands of their vineyards, which could not, he supposes, be effected by our common hoes. It is likewise suggested, that this hoe may be found of much advantage in digging up and cultivating the land in steep mountainous situations, and in the forming of compost manures of lime and earth in the corners of fields, where the plough cannot be brought to perform the work: also in very hilly places, where the spade cannot be conveniently made use of. It may likewise, it is imagined,

be beneficial in hand-digging the head-lands in arable fields, as well as in orchards and plantations, in different instances.

But, in order to effect the business of field-husbandry in a better and more perfect and expeditious manner than by the common hand-hoes, other sorts have been contrived, which perform the work on several rows at the same time, and which are capable of being varied so as to suit different purposes. These are the invention of Mr. Ducket, jun. and, on lands of the light descriptions, may be had recourse to with success. At *fig.* 10. is the *treble hoe*, by which three rows are finished at once, the person using it advancing in the usual manner. It weighs, with the three heart-hoes, 7lb. 9oz. and is capable of being wrought by a woman, who has been accustomed to the business. By the use of this tool, a much finer tilth is said to be stricken into drills for receiving different sorts of seeds, and with greater readiness, than by that of the corner of the common hoe, along any line of direction; as, after one drill has been correctly opened, the succeeding ones must of necessity be formed with exactness.

At *fig.* 11, is another form of this *treble hoe* for making drills, in which the shares are set for drawing, the workman going backwards in making use of it; and, in order that more pressure may be given without tiring the wrist, a rope is added, which, passing round the operator's body, draws from the place where the hand would have acted: the weight, with two twelve-inch hoes, is 7lb. 3oz. At *fig.* 12, the hoes are shown as employed in making trenches in gardens, for receiving the manure in planting potatoes, and which are formed very expeditiously by striking in a line, bringing the mould up into a sort of a half ridge, and then finishing it by turning and going back. It weighs, with three straight six-inch hoes, 6lb. 11oz.

At *fig.* 13, are represented the two outward hoes, a space being left in the middle between them, for hoeing on each side of a drill of any kind of plants with facility, and without injuring them.

It has been contended by the inventor, that, by means of this tool, two acres of barley may be hoed in a day, and that it makes good work on oats or wheat.

Besides these, there are still other sorts of hoes of the hand sort, such as the *double hand-hoe*, an implement which was formerly in much esteem, as being cheap and simple in its construction, and very convenient on the lighter sorts of soil.

The *Breast*-Hoe is also a sort of tool of this nature, that has been recommended by some, as being more advantageous for particular purposes than those of the common kind, especially for such grain-crops as are sown in rows at narrow distances, as executing the business with more expedition, and in a more perfect manner.

Macdougal's Hoe, which is drawn by a man before, and directed by another behind, is likewise a very useful tool in many cases, especially for crops that stand at large distances in the rows, so as to admit it. It might, perhaps, be better to have the wheel in this tool solid, as open wheels are always liable to fill up.

Horse-Hoe, a very powerful tool of the hoe kind, which is much employed in the cultivation of crops that are sown or planted in the drill or row method, with sufficiently large intervals. These, like the hand sort, are of very different forms and constructions, according to the uses for which they are designed. And likewise vary much in their weight and size, as well as the shape of the hoes or cutting parts. These sorts of hoes, from their executing the work, when constructed for the purpose, on a number of rows at the same time, have much superiority in point of dispatch, as well as in performing the operation to a greater depth, and in a more perfect manner, over those of the hand kind.

As, by means of these hoes, the mould can be more effectually stirred about the plants, and the land be kept more clear and free from weeds, they should be constantly employed, wherever the nature of the crop, and the method in which it has been sown, admit, as saving much labour and expense, as well as executing the business in a far more efficient manner.

The implements of this nature, that are in use in different districts of the island, are extremely numerous, being frequently altered by cultivators to suit the particular uses and objects they have in view; as well as to suit the particular states and circumstances of their lands, and the machines of the drill kind that are employed in putting in the crops.

Mr. Amos has contrived an *expanding horse-hoe*, and a *six-shared horse-hoe*, which are found to be useful practical implements of this kind. The former possesses considerable superiority, from its being constructed with expanding shares, which can be set to different distances, as may be required, within the limits of twelve and thirty inches, being capable of stirring the earth in intervals of any extent between these extremes.

It has been found useful in hoeing beans, whether drilled, or sown in equidistant rows; as well as potatoe and cabbage crops. It is much used in Lincolnshire.

The harrow, which is attached to it, is found advantageous in clearing lands from successive crops of weeds, as well as in bringing them to a proper state for the purpose of cropping.

And the *six-shared horse-hoe*, as being regulated in respect to the rows of crops, may likewise be employed for grain, where the intervals are small, as nine inches. And it is also capable of being applied in the preparation of stiff, stony, or gravelly sorts of land; or in such as are much overrun with weeds, by having recourse to tines or coulters in the places of the triangular hoes; which should be so fixed, as to cut and divide the superficial parts of the ground, while the inferior ones are at the same time stirred in an effectual manner.

At *fig.* 1, in *pl.* LIII. is given a profile of the *expanding horse-hoe* and *harrow*: A, is the regulating

wheel, 10 inches in diameter, which is capable of being adjusted, so as that the shares may cut at different depths; B, is the beam, six feet and a half long, and three and a half square; C, is the leading share, which is rivetted on the shaft D, which is an equilateral triangle of twelve inches; D, is the shank of the leading share, which is fixed in the beam, two inches by half an inch square; E, represents the edge of the expanding shares, which are two feet long, and five inches broad, shaped as by the figure; F, represents the left hand mould-board, which is made of a piece of light wood, two feet long, and ten by six inches square: These mould-boards are hooked on the iron rod G, and fixed to the shank H by a screw-bolt; G, is an iron rod, which passes through the hind part of the leading share, the forepart of the expanding shares, the mould-board hooks, and the beam, in which it is fixed by a nut and screw on the upper side; H, is an iron shank, fixed to the expanding shares, kneed at the top, where a circular part passes through the beam, and regulates the width of the expanding shares; I, the handle, which is three feet from the ground line; and that part which the man grasps is three feet behind the end of the beam; K, is a profile of a small triangular harrow, with expanding sides fixed to the end of the beam, as shown in the figure.

At *fig.* 2, a horizontal view of the same implement and harrow is given. B, the beam, in which are mortices for the reception of the shanks of the regulating wheel, and the leading share; C, the leading share, to which the expanding ones are fixed by the bolt G, as represented in *fig.* ; D D, the expanding shares, fixed to the leading one C; E E, the circular radiuses of the shanks that are fixed to the inside of the expanding shares: these go through the beam, and regulate the width of the hoe, and are fixed to any width, by two bolts passing through them and the beam. The dotted lines F represent the upper part of the mould-boards, and show how they incline outwards behind, how they are fixed to the shanks of the expanding shares, and how they are hooked on the iron rod, which passes through them, the leading share, and the beam; G, the middle beam of the expanding harrow, three inches, square, and two feet nine inches long; H H, the expanding buns, three inches square, and two feet six inches long: These buns are fixed to the middle one by strong hinges, as seen in the figure; I I, two circular radiuses made of iron, and fixed in the expanding buns. These radiuses pass through the middle beam, in which there are two holes, corresponding to those in the radiuses, for setting the harrow to any width. All of which, it is observed, are so plain, that any further description would be unnecessary.'

The writer assures us, that the utility and implicity of this hoe have induced many farmers to adopt it for hoeing such crops as mentioned above.

And at *fig.* 3, is represented, in profile, the *six-shared hand-hoe*, made on the principle of the pentagraph, and so as to remove with great care to the right or left; by which means, the person who manages the hoes is able to keep them in the middle of the space between the rows of corn. This hoe is not the invention of Mr. Amos, but he has improved it, he says, by adding the two castor-wheels, which regulate the depth: A, is a section of the coulter-bar of the drill-machine, to which this horse-hoe is fixed by an eye-bolt, as seen in the figure; B, is a piece of ash-wood, three inches square, sixteen inches long, and made narrow before towards the eye, which hooks on the bolt that goes through the coulter-bar; C, is another piece of ash-wood, three inches square, and thirteen inches long. These pieces of wood are fixed between iron bars, at the distance of twelve inches from one another, by four screw-bolts, as per figure. The iron bars are about two inches broad, half an inch thick, and forty-one inches long; D, is a section of the coulter-bar, four by three inches square, and moves in the oblong space between the two pieces of wood and the iron bars; G, the share, with its shank fixed in the coulter-bar; the shank is sixteen inches long, one inch and a half by half an inch square, and is rivetted on the hind part of the share; E, the castor-wheel, eight inches diameter, and about two inches at the centre. This wheel not only regulates the depth of the hoes, but also makes the whole machine more easier, either to the right hand or left; F, the handle, fixed to the piece of wood C, by two bolt and screws, as per figure: this handle projects about twenty-five inches behind the side frame, to which it is to be fixed, and is about thirty-four inches from the surface of the ground.

At *fig.* 4, is given a horizontal view of the same implement. A, represents the coulter-bar of the drill-machine, to which the hoe is fixed by two eye-bolts. B, the iron bars, between which the coulter-bar moves upon a bolt, which passes through the whole. In these bars are five bolt-holes, for shifting the bar with the hoes forward, backward, or diagonally. D, the coulter-bar. A, the bar, in which the hoes are fixed. The *figs.* 8 and 9, show how to fix the hoes, when the rows of corn are eight or nine inches asunder. G G G, are three shares, in the form of an isosceles triangle, the two foresides of which are seven inches long, and the hind-side six. As eight or nine inches is the best distance between the rows of grain, so hoes of six inches wide are the best adapted to those distances, and will answer very well for both. F, the handle of the left side, fixed to the end of the side frame by two bolts, as shown in the figure. The numerical figures 1, 2, 3, and 4, represent four rows of corn at nine inches asunder. At *a* is a horizontal view of a coulter, of which there are seven, which are used instead of the triangular hoes, on stiff, gravelly, stony, or on soils infested with couch-grass. These coulters are thirteen inches long below the coulter-bar. And at *b* is a profile of one of the same coulters, made sharp on the fore-edge for cutting the ground with more ease, while the hook part stirs the earth below.

A very useful horse-hoe for performing the business of hoeing several rows at a time, is also formed from

Mr. Cook's drill-machine, by removing the coulters employed in that operation, and substituting the shares for hoeing. A representation of this implement, in the state proper for this purpose, is given at *fig.* 2, in *pl.* XXX. In employing it for horse-hoeing a crop of any kind of corn, drilled at nine inches a part, the horse must be conducted along the third row or drill, beginning to number the rows from the left-hand side of the six rows drilled at one operation of the machine. And the person who attends the hoes must keep the pin *b* directly over the third row of corn; and, as long as he does this, it will be impossible for him to injure it in the least. But for horse-hoeing corn at twelve inches apart, the horse must be conducted along the second space between the rows or drills, beginning to number the spaces from the left-hand side of the five rows drilled at one operation of the machine. And the person who attends the hoes must keep the pin *b* directly over the middle of the second space, described as above. The same rule will hold good for hoeing at different distances. Where the space between the two adjoining outside drills may happen to be irregular, or too narrow at some places for the hoe to pass, it may be advisable to take out the share, which would otherwise hoe that space, and leave it to be hoed by hand.

Soils of different textures will require to be hoed with shares of different sizes: nothing but experience can point out the size, which is best adapted to any particular soil. In all light sandy soils or loams, or any other soils sufficiently pulverised, shares from five to six inches broad for nine-inch drills, and eight inches broad for twelve-inch drills, will work safely and effectually. In strong clays, intermixed with pebbles, the hoe-shares must not be so broad; and it may not be impossible to find some such soils, as will bid defiance to all flat hoeing whatever. If, nevertheless, the texture of the soil in the spaces of the rows of corn is torn to pieces by long narrow plates of iron, resembling points, or chissels, being introduced into the hoe-share shanks *a a a a a*, at *fig.* 2, *pl.* XXX. instead of the hoe-plates, the advantage resulting from such a process will be very considerable.

The hoe-plates may be set to enter the soil deeper or shallower, by lowering or raising the shanks *a a a c c*, in the respective mortises in the beam, or by lowering or raising the hooks applied to the shank *c c*, on the axis of the wheels, by which the hoes are drawn.

Lands cannot be too level on the surface for effectual and expeditious practical horse-hoeing. But where lands or ridges are formed so round, that all the hoe-plates cannot be brought to work at equal depth in the soil at the same time, so many as cannot be brought into use may be laid aside.

This horse-hoe may, it is observed, be applied to many useful purposes besides hoeing crops of drilled corn, particularly for cutting up the rows of stubble as soon as the crop is carried, with such weeds as might escape the hoe, and for stirring of fallows, &c. &c. after the rate of ten acres a day, with one man, a boy, and two horses: particularly in the busy time of harvest, when it would be impossible to spare so many men and horses as would be required to stir the land with common ploughs, so as to answer the intended purpose. And, by means of the same expeditious method of cutting up stubbles, immediately after the crop is carried, or rather before it is carried, as soon as it is cut and set up, in order to gain time for the sowing of grass-seeds a second time, where they may have missed, on cole, or rape, or turnip, for food of sheep or cattle in winter or spring, extraordinary advantages may be derived.

The *drill horse-hoe* is a simple and convenient implement of this nature, which has lately been employed by Mr. I. C. Curwen with much success and advantage in hoeing and cleaning drilled wheat-crops. In presenting it to the attention of the Society for the Encouragement of Arts, &c. he makes the following observations on its use in his own trials: "The simplicity and ease with which it is worked has," he says, "enabled him this season to give his wheat-crop, which exceeds one hundred acres, two cleanings, at an expense somewhat less than a shilling per acre each operation; a man and boy, with one horse, being able to clean above seven acres per day. The direction of the harrow, to prevent its injuring the grain, is effected by an alteration of the chain, by which it is attached to the wheels. The distance of the teeth from the centre tooth must be regulated by the width of the drills. In case they exceed a foot, the harrow should be broader, to admit of another row of teeth. To clean at nine inches, two inches and a half is allowed on each side of the centre tooth, by which means every part of the earth is cut between the rows of grain. The size and strength of the teeth must be regulated by the nature of the soil." He was indeed prevented from offering it to the notice of the public, till encouraged by those whose experience and knowledge was much greater than his own.

It is represented at *fig.* 5, in *pl.* LIII. in which is shown the carriage within the shafts A, of which the horse is placed; the carriage wheels are intended to be half the width of the butts or stitches, so that one going up, and once returning, will be sufficient to clear each butt from weeds. B, the hoe or harrow, which is attached to the carriage by the chains CC. The harrow may be raised higher or sunk lower, or placed more on one side or another, as occasion may require, by altering the position of the chain, as will appear by an inspection of the plate. DDDDDD, six double rows of teeth or knives, which are so placed in the frame, that each double row may pass up the interval betwixt the rows of corn, and cut or pull up the weeds that grow in such intervals without injuring the corn. These knives are strong, and have a sharp edge in front. EE, are the two handles, by which the person who holds them may direct the knives or teeth of the harrow to pass in straight lines up the intervals. And *fig.* 6. exhibits the under side of the weed-harrow, in order that the positions of the double row of knives, and of the space left to prevent the corn being injured, may be more clearly seen.

It is observed, on the use of this hoe, by Mr. J. D. B. Dykes, "that its effect appeared to him most highly beneficial in clearing away in the spring all the weeds that had grown during the winter amongst the wheat, without the least injury to the grain; and also in raising up the top soil, which had become sad and heavy, and thus enabling the spring shoot to take root more easily: and, at the same time, it covers the roots of the corn with fresh soil, which are often left quite bare by the washing of the rains in winter, and so subject to be killed by the frosts. It also enables the farmer to sow his barley much earlier than he could broad-cast, as it will both clear the corn previous to sowing the grass-seeds, and afterwards harrow them in." In fact, its utility has appeared to him so very great, that he was induced to adopt the plan of sowing his corn with the drill upon his fallows.

Waistell's horse-hoe is another tool of this kind, which seems to be of a practical nature. By combining the powers of the hoe and harrow, the inventor or improver has produced an useful implement for working of the land in the intervals of drilled turnip and other crops, that are wide enough in the rows for its being employed. In bringing it before the Society for the encouragement of Arts, &c. Mr. Waistell gives the following account of its uses: "It enables the farmer," says he, "to cultivate those intervals as completely as a well wrought fallow, so long as the horse can travel therein without injury to the growing crop. He knows not who the meritorious inventor is. The first he saw, was a few a years ago, at West-Park, near Barnard Castle. This was brought from Carlisle by his brother; and many have been made from that pattern, and are now in use, and are highly approved of by farmers in the neighbourhood of Barnard Castle, where the turnip-crops are now generally raised in drills, about twenty-seven inches apart. This mode was first introduced there about twenty-three years ago, before which time they were all sown broad-cast."

It is seen at *fig.* 7, in the same *plate*, in which is shown the hoe-harrow, to which the horse is to be attached by the upright iron A; in which are a number of holes to admit the drag-chain to be put higher or lower, as may be found necessary. This iron is at one end fixed firm in the fore-part of the machine at B, and at the other end to the further side or wing C. D, is the nearer side or wing of the machine, and moveable by a joint at E. This wing may, by this means, be expanded or contracted, as the interval between the rows to be cleared of weeds may require. F, a strong wedge-like tooth in the fore-part of the machine to tear up the weeds, which are deep in the ground. G G, other teeth more slender, fixed in the two wings or sides of the machine, and which are also intended to tear up weeds, and loosen the earth. H, H, H, three triangular hoes. That which is in front has a strong iron fixed in its centre; the two others, at the hinder part of the machine, have the irons fixed at the further corner of each. The intent of the centre hoe is to cut off the weeds on each side next the crop, and to lay all the weeds in a ridge-like form in the middle of the path to dry and rot. I, I, the handles, by which the machine is managed. K, a slender iron bar, with a peg and holes to direct the distance of the expansion or contraction of the machine. L, a strong iron vice, which works in a groved iron, fixed to the inner side of the wing D, and which, when screwed down, holds the machine firm at the distance of expansion wanted for use.

Fig. 8. shows, on a larger scale, one of the hinder hoes separate from the machine, and the manner by which it may occasionally be raised or lowered in the machine by a pin and holes.

If this implement should be found to answer on a more extensive trial, it will, perhaps, render little further necessary in the culture of turnip-crops.

HOEING, the operation of breaking, dividing, and pulverizing the soil between the rows of corn that have been drilled, or between plants that have been set in rows with intervals between them, by means of implements constructed for the purpose. It is one of the most important operations in drill-husbandry, and which should never be neglected when that culture is attempted.

It is observed by Mr. Amos, in his Treatise on Drill-Husbandry, that the advantages arising from hoeing are great and numerous. By it weeds are destroyed, the pasture of plants increased, the fertility of the soil greatly restored, vegetation promoted, and the land half prepared for a succeeding crop. Rain, snow, hail, dew, &c. are easily absorbed by the earth, when it is kept in a loose, light, pulverized state; whereas, the same principles on a compact hard soil reach no further than the surface, and are again exhaled by the sun and wind with little or no benefit to the soil they fall on. Pulverizing the land, he thinks, is wonderful efficacious on stiff or loamy soils; but, on light sandy and thin ones, too much ploughing and hoeing may prove hurtful, by allowing the moisture and other matter to exhale and fly off in too great proportions.

It is added, that, in all operations of hoeing, the land should neither be too dry, nor too moist, but in a due medium with respect to both. That light dry soils may be hoed almost at any time; but that stiff moist soils can only be hoed to advantage at particular seasons; and that is, when the soil is in a crumbly mellow state, in respect to its parts.

This is a process that must be performed differently, according to circumstances. For it has been observed, that on the stiff heavy loamy kinds of land, or such as are much disposed to throwing up weeds, it may be more frequently requisite, than on the light porous sandy sorts, which may be much injured by too great a dissipation of their moisture, and other valuable properties, by over frequent stirring. In grain or small seeds, when drilled with narrow intervals, the hoeing should be done with small shares, proportioned to the distance between the rows. But for pulse, and other plants, that are drilled or set at a greater distance, larger and stronger

instruments are necessary. The nature and construction of different tools of this kind have been explained and described under their proper heads, and in treating of the culture of particular plants and crops. See *Hoe.*

The writer of the New Farmer's Calendar considers this operation as considerably more advantageous, when performed with the latter sorts of implements, than with the common hand-hoes, from the circumstances of their loosening the soil to a greater depth, and thereby affording more copious nourishment to the roots of the plants. "Hence," says he, "the vast importance of the operation of horse-hoeing during continued drought in the spring or summer; and to this cause, in a great part at least, it may probably, he thinks, be owing, that lucern, usually sowed and horse-hoed, is said to endure drought so much better than natural grasses, and to appear green and flourishing, whilst these are withered and burned up. The almost instantaneous benefit conferred by this operation upon cabbages, which are root-bound from a baked soil, or upon wheat, which appears yellow and sickly in the spring, are its best recommendation." He has "seen those crops, after being worked in the rows, from a withered sickly hue and flagging condition, turn erect, and change their colour to a deep and flourishing green within twenty-four hours. Nay, of such importance, continues he, is the operation of deep and effectual hoeing held by experienced people, that he has known a Kentish farmer, in a time of great drought, send his men with their spades into the alleys of peas, being afraid of damage from horse-work."

It is further stated, in the same work, that "the number of hoeings required in the drill-culture may, perhaps, be generally stated at four, although five may be required by extraordinary circumstances. The chief rule in course is the presence of weeds, which are never to be permitted, whatever may be the number of hoeings required." He adds, that "the first hoeing of wheat (of such, he means, as has been sowed sufficiently early to admit that operation in autumn) must never be performed until the plant shall have more than one blade; and it may be deferred until it hath four or five leaves, provided no urgency appear, and that the operation be completed before the setting in of the winter. Tull, says he, directs to hoe from the rows up and down the first time, which leaves a ridge in the middle, and a furrow or channel on each side between that ridge of the plants, to catch the rains and snows of winter; and, doubtless, by that method the greatest possible superficies of the soil is exposed to the influence of the atmosphere. He asserts, it is said, on experience, that you can scarcely plough too deep the first time, nor approach too near the rows, provided you do not cut the plants, or absolutely root them up; and that, by thus laying the roots almost bare, and exposing them to the severity of the frosts, you do them no manner of injury; a practice about the rationality of which he is at present uncertain, having always entertained the idea, however erroneous, that the roots of all plants were comforted and strengthened, during the rigours of winter, by being earthed up; and he believes Miller held the same opinion. Tull, however, acknowledges, that, in very light lands, a great caution is necessary in approaching the rows. He remarks it as a common error of servants, in the use of the hoe-plough, that they merely skim up and down the midst of the alley, neither going sufficiently near the rows, nor sufficiently deep; and recommends, as an amendment of this error, to trench or draw a second furrow to a proper depth immediately, if practicable; otherwise, before the ridge be turned back in the spring. The plants will thus stand as it were on a brink of a trench; by which they will be drained, and kept constantly dry: they will also be sheltered, by the ridge, which has been thrown up. It will, he thinks, occur to those who drill upon strong soils, that there is danger in deferring too late their first horse-hoeing, lest the land become too wet to work" with propriety, or in a sufficiently mellow manner.

In respect to the spring-hoeing, it "may be given," he says, "as soon as the frosts are out of the ground, and the surface is sufficiently firm and dry to carry the cattle: the ridges between the rows are then to be split, and the mould, finely pulverized and manured by the frosts and snow, thrown to the roots of the plants; the fibres of which, expanding to the general warmth of the season, are now ready to attract every particle of nourishment within their reach. Nor is there, adds he, the smallest damage done to the roots by the breaking or disturbing with the hoe those numerous filaments or threads, which branch out on every side; since nature (as may be observed in all vegetables), in a very few hours, not only remedies the defect, but ever provides mouths or suckers in proportion to the nourishment offered; nor is it possible, the nourishment being simple earth or manure, not too gross to overfeed or glut a plant; which, nevertheless, may be effected, according to his observation, by excessive and superfluous quantities of rank dung, poisonous to the vegetable juices; whence atrophy or consumption will ensue, and the plant become stunted, or even wither away. The cultivator must, he conceives, judge of the necessity of lightly harrowing and rolling, previously to the spring-hoeing the rows" of the crops.

With regard to the succeeding hoeings, the number and periods of which must of course be at the farmer's direction, "they have two objects; first, to turn in the weeds the instant they are ready; and, secondly, to move the surface before it becomes baked and impervious to the dews: this last object must be watched with the utmost attention in a thirsty season, as the weight of the crop absolutely depends upon it; and here the superiority of the row system, he thinks, clearly manifests itself. There may subsist a further reason for an additional stirring in exhausted and impoverished soils; the plants on which, having extracted all the food of their last pasture, may require an earthing up of fresh mould, at the

critical time of their coming to perfection. Shallow ploughing can never, he conceives, do any injury, at whatever season; but deep ploughing must never be admitted near the rows in spring or summer. The middle of wide alleys may be ploughed deep; and in this case, at the last hoeing, the plants are left well earthed up" with the mould that has been made fine in the intervals.

With respect to the modes of performing the process, the author also remarks, that "the old method of very wide intervals for the horse-hoe, whilst the seven-inch rows upon the ridges were trusted entirely to the operation of the hand-hoe, seems now to be exploded, and to have given way to the improvement of horse-hoeing the rows a considerable number at one time." From the best inquiries he has been enabled to make, Ellis and Ducket were the first who used this expeditious method. And "there can be no doubt, he thinks, of the superiority of the practice over hand-labour; but, practised upon strong and rough soils, he is inclined to question both its efficacy and correctness, and to prefer the superior steadiness and force of the single operation of the hoe-plough. He ought, however, he says, to observe, that, on stating this objection to the Rev. Mr. Cooke, he assigned reasons for holding a different opinion, which he supported by quoting the practice of several cultivators of strong soils, particularly Mr. Boote, of Atherstone, near Stratford upon Avon; Mr. Jones, of Chaily, near Lewes, Sussex; and Mr. Thorn, of Ealing, Middlesex. With all possible deference, however, to superior experience, he remains, he says, still unconvinced. There is nothing, he conceives, of greater consequence upon clays, than deep and effective tillage; and upon such soils it is, that the farmer is so commonly injured by the dishonest indolence of ploughmen, whose constant aim is, as light a surface-skimming as possible, in defence of which they have a fund of the most plausible reasons. He has observed very frequently, upon strong lands, a fine and apparently mellow and well pulverized surface; but, taking the spade to be convinced, this fine tilth has proved to be only half-spit deep, all beneath turning up in clots, which would submit to no tool of inferior force to the mattock. Now, says he, the part of such a soil left untilled is nearly useless for the purpose of vegetation; and, if labour will at all repay its expense, the more effective it is, the more certa n; and in the greater proportion will be the repayment. For reasons like these, he has doubted the advantages of scuffling in seed, unless, indeed, upon soils, which have had the previous advantage of deep and thorough pulverization from the hoe-culture:" and these reasons, also, equally influence his opinion in favour of the superiority of the single hoe-plough, with rows of ample widths.

It has, however, been stated by the author of Phytologia, that, "early in March, Mr. Coke uses the hand-hoe, which, for hoeing the rows of wheat and peas, is about six inches wide; and, for hoeing those of barley, about four inches wide. By this hoe, the surface is not only turned over, and the weeds between the rows rooted up, but it is also accumulated about the roots of the growing corn, and covers, and consequently destroys, the low growth of poppies amongst them, which are a very frequent weed in that part of the country. A second hoeing is performed about the middle of May, and the soil is again not only cleared from weeds, but accumulated against the rising corn, each of which hoeing costs about 20*d.* per acre." But that, "nevertheless, he is informed, that some attentive agriculturs use the horse-hoe belonging to Mr. Cook's drill-machine, though the rows of corn are but nine inches from each other; and assert, that this occasional trampling of the horse on the young plants is of no very ill consequence, a circumstance well worth observing, he says, as it removes the principal disadvantages of the horse-hoe, which consists in the too great distance of the alternate rows of the corn-plants." He adds that, "by the earth being thus accumulated against the roots of the corn, it is said to tillure, or tellure, much; that is, to throw out four or six stems or more around the original stem, and thus to increase the number of ears, like transplanting the roots; insomuch, that Mr. Coke obtains, by this method, between four and five quarters of wheat in every acre; which, in the broad-cast method, did not yield more than three quarters an acre, besides saving a strike and a half of the seed corn, unnecessarily consumed in the broad-cast method of sowing. To this should be added another advantage, that, as the land is thus kept clear from weeds, and has its surface twice turned over, and thus exposed to the air, it is found to save one ploughing for the purpose of a succeeding crop of turnips." But how far this tilluring may be advantageous without injuring the roots, by over exhaustion, has not yet been fully shown by any satisfactory experiment."

It has been remarked, by an experienced writer in the second volume of Recreations in Agriculture, &c. that all the various operations of horse-hoeing may be executed by the common swing-plough in an equally effectual manner, as by any of the hoe-ploughs usually made use of; and that the operation, as practised by Tull, Chateauvieux, and others, appeared to him, from the period he first saw it performed, to be imperfect, and stand in much need of amendment. "The imperfections were, in the first place, that when the earth is turned away from the rows of plants, by opening a furrow on each side of that row, and laying it towards the interval, the roots of the plants being left naked on both sides at the same time, and the ridglet on which they stand being thus left exposed to the drying summer winds, the plants are liable to suffer a considerable check, and must, of necessity, be greatly damaged by it, unless precautions be adopted to guard against such injury; which greatly tends to frustrate the beneficial effects of this operation. These precautions are, first, not to go nearly so close to the row on either side as might otherwise be safely done, but so as still to leave a considerable quantity of earth for the roots to bed in; secondly, not to go nearly so deep

in performing that operation as might otherwise be safely done; because the small ridglet, when a furrow is open at the opposite side of it, could not oppose such a resistance to the left-hand side of the plough, as to enable it to move out of its place the fast earth, which requires to be turned up by the right-hand side of the plough; and, thirdly, that instead of being able to make the plough go *perpendicularly* downward, very near the row, it must be so conducted as to make the cut slanting outward at the bottom, otherwise the earth would moulder down from the top, and leave the roots of the plants bare. From a combination of all these particulars, it necessarily follows, that a very large proportion of the soil must be left near where the plants grow, that never can be touched by the plough, and of course can receive no benefit whatever from hoeing.

In the second place, when the earth is to be turned back towards the rows, we must suppose that a plough, with a double mould-board, is made to go right down the middle between the rows, so as to split the ridglet in two, laying a part towards each row; which is the best and the cheapest way wherein this operation has been hitherto performed. By this method, the loose earth, which was formerly turned from the row, is now turned back towards it; and a part of the solid earth, which was in the middle, is also lifted up out of its place, and is thrown towards each row. Every succeeding hoeing is only a repetition of these two steps of the process, so that it is unnecessary to repeat them here.

"But, in order to show the effect of these operations more fully, the diagrams *fig.* 1 and 2. in *pl.* LII. are given: in both these, the lines A B, A B, represent the surface of a ploughed field, and C D, C D, the bottom of the ploughed part of the field, which is here represented as being six inches in depth; this being the whole of the bed in which the plants are to find their nourishment. Let E E represent two rows of plants intended to be horse-hoed, that are placed here at three feet apart. At the first operation, the plough makes the furrow *b c e*. *Fig.* 1. turning the earth from the rows of plants E, and returning on the other side of the row, makes the furrow *c d A*, leaving the rows of plants E standing upon the eminence *d a b c*. The same operation being performed on the row F, it is left as in the diagram; and so through the whole field. The furrows in this case are represented as going to the depth of three inches, which, it is supposed, will be admitted to be a fair average of what is actually done in practice; and the distance *a b* is nine inches, which is also as little as can with safety be made in cases of this kind. The reader can, by bare inspection, perceive at one glance, what a very small proportion of the mould is stirred by that operation, and of course how imperfectly it answers the purpose intended. Had an attempt been made to approach nearer to the row E on each side, and to go perpendicularly downward, and so deep as to reach the bottom of the manured soil, as is represented by the dotted lines *f h i*, and *g k l*, it is evident, that the small pillar of loose earth *f g h k*, when deprived of all support on the opposite side, could never have resisted the pressure of the plough, while it forced out the earth in the opposite furrow; nor could it have stood in this position, nor retained moisture to preserve the plants alive. *Fig.* 2. represents the same field, as it is left after the second operation; in which the furrow made by the double mould-board plough is represented as four inches deep (being eight inches perpendicular from the surface of the raised up earth). It is needless to multiply words to show how little of the mould can be actually removed by these operations, let them be repeated ever so often; the bare inspection of the figure shows it in the most perfect manner. Even allowing that the succeeding operation should go an inch deeper than the first, the case will be very little altered. More than three-fourths of the vegetable mould must remain untouched by these superficial and deceptious operations. It was with a view to obviate such radical defects, that he was induced to lay aside these implements, and to perform the operations by means of a common plough; the manner of doing which he now proceeds to explain: Let *fig.* 3. represent the same field as before, with the rows of plants E F growing upon it. Instead of beginning the first hoeing, as before, by running the plough along the right-hand side of the row E, you must now go along the left-hand side of it, so as to lay the earth toward that row, as at *a b c*. Having performed this operation on the left-hand side of the row E, and supposing, for example, the plough to have been brought back to the same end of the field from which it proceeded at first (without inquiring now how that is to be done), you are to suppose that it begins between the rows E and F, by drawing the furrow marked *d e f* (the space between *d* and *g* being presumed to be at this time solid mould), so as to turn the earth toward the row F. Then (the plough being again brought back to the same end as at first), draw the furrow *h i k*, which, by having had an open furrow to the right-hand side of it, can be with ease made deeper than the former. Then, by going a third time in the same direction, you draw the furrow *g l m*; going, in this case, as close to the row as you please, as the solid earth on the back of it prevents it from being deranged. For the same reason, and also because the whole of the fibres on the left-hand side of the plant are in this case left entire, it is in no danger of suffering by having the roots on this side cut very near; and, there being plenty of mould on that side to prevent it from suffering by drought, the operator is at liberty to go much closer to the row than could be done in the usual mode of hoeing, to cut much straighter downwards, and also to go much deeper than in the other case. In this way, the whole of the earth may be stirred even to the very bottom of the furrow, if you so choose it. When the operator wishes to go deep, he will naturally take a furrow of a smaller breadth, so as to proportion the weight of the furrow to the strength he can apply to turn it. In this way, it is obvious, he says, that, by this first operation, a much greater proportion of the mould is turned over than by the

common process, as in *fig.* 1.; the black, in both cases, representing the part of the mould that is left untouched. Let us now see, says he, what takes place in the second hoeing. *Fig.* 4. is intended to represent the field after it has undergone the second hoeing; in which, as in all the other diagrams, the dark parts represent the mould that has been left untouched. In performing this operation, you are to suppose that all the steps of the last hoeing are directly reversed. That is to say, instead of beginning at the back of the row E, and turning the furrow towards it, the plough begins on the right-hand side of the row F, and, going now in an opposite direction to what it formerly took, it of course now turns the furrow towards the row F. That being done, you are to suppose that, still holding the same direction, it is made to pass between the rows F and E, so as to open the furrow *n o p* (the dotted lines *q r n* representing the open furrow that was left in the first hoeing. A second furrow is then drawn in the same direction, as to form the opening *s t u* (the dotted line *n s x* representing the surface of the mould as left at the last hoeing); and a third furrow, drawn in the same direction, leaves the opening *x y z;* in which situation it remains till the third hoeing commences. Proceed after the same manner till the whole field be finished."

It is added, that "every succeeding hoeing is directly the reverse of this, and ought to differ from it in no other respect, unless it be in that, at each succeeding hoeing, care should be taken not to go quite so close to the rows of plants as in the former hoeing; but leaving a space of two or three inches more of mould for the roots to grow in undisturbed: thus will the large roots be suffered to remain untouched, while small fibres only will be cut off; and thus the absorbent mouths be greatly multiplied; while they are furnished with the best prepared mould, in which they can freely strike, so as to furnish the plants with the greatest quantity of nourishment that the nature of the soil can possibly supply. The furrow, likewise, may then be made so deep as to reach the bottom of the manured mould, in all cases. Thus every inch of the mould, except, perhaps, the small square bit *q t w r*, under each row, will receive nearly as complete and thorough a summer fallow, as if no plant whatever had grown upon the ground. Let this, says he, be compared with the case *fig.* 2, and the difference between the merits of these two operations will be made obvious."

He observes that, "in consequence of this perfect kind of hoeing, the plants will advance with a degree of vigour, that can never be attained under any other circumstances. The ground will be kept continually moist; so that, in the driest seasons ever experienced in this climate, their leaves will exhibit the most healthy verdure, and extend to such a length in turnips and cabbages especially, as quickly to close upon each other, and, in a short time, leave no appearance of the rows. To prepare for this, the operations must be hastened, so as to put the soil into the finest possible tilth before the hoeing be finally closed; after which time the roots must be left at full liberty to spread with freedom in the fine mould that had been prepared for them, and the plants will thus be made to attain the utmost degree of perfection of which they are susceptible. It now only remains for him to show in what manner the last operation is to be performed, so as to leave the plants in a proper state. Let us suppose, then, continues he, that it is a field of cabbages, there is no necessity for discontinuing the hoeing, because the leaves nearly meet each other in the middle, between the rows; for a well trained horse, who has been accustomed to this work, will walk in the interval without being in the least discomposed by it, and without doing the smallest hurt to the cabbages while the leaves are in this state; for, although these will brush close along the sides of the horse, yet they will yield to that pressure, and resume their former position when he is past, as if nothing had happened to them; the horses' feet moving with freedom underneath the leaves. Let us suppose farther, that at the last hoeing the field had been left as represented by the dotted line *d e f*. *Fig.* 5. having the furrow turned towards the row F, and the earth strongly laid up to the stems of the cabbages. Let the plough, when it is intended to finish off the operation, be introduced, so as to turn the earth towards the row E. In that case, the operator, by inclining his plough a little to the left, makes it cut in an oblique direction, instead of perpendicularly, as he has hitherto invariably worked; and, striking deep, so as to go quite to the bottom of the manured mould, he forms the opening *f b g*, so as to leave a clear opening in the middle with the loose earth closely laid up to each side. If the operator be sufficiently expert, this will be done in such a manner, that you could not easily tell in what direction the plough had been last drawn, the earth being so equally laid to both sides. The old Scotch swing-plough, with a straight mould-board, performs this operation in the most complete manner; but it can be done, though in a less perfect manner, by any kind of swing-plough.

"He now comes to explain a particular, which he has found more difficult to render intelligible by words only, than any other part of this process; but which, when once understood, will be found to be as easy in practice as can be conceived. The reader was desired not to give himself the trouble of inquiring how the plough was made to hoe many rows in succession, though all in the same direction. It now remains that he should show in what manner the plough can be turned successively to the same point, without any waste of labour. With that view, let the reader cast his eye upon the diagram *fig.* 6, the black lines on which are intended to represent rows of plants of any kind on a field regularly laid out for horse-hoeing. The plough, we shall suppose, is to start at A, and, going right forward, it enters the field on the right-hand side of the row marked B; and, proceeding forward to the other end of the field, it opens a furrow, laying the earth from the row B towards the adjoining row to the right; then, turning to the left-hand, it returns on the other side the same row, laying the furrow from it on that side

also. In this instance, the row B will be left precisely in the same state as every row is left after the first hoeing in the Tullian method. The plough proceeding forward to the end where it begun, which, for distinction's sake, we shall call the lower end of the field, it then turns to the left, and goes up the row 2, having the second row (or that row towards which the earth moved by the last furrow was laid) on its left hand, so as to turn the earth from it on that side. Proceeding forward, it turns at the head toward the left-hand again, and returns down the furrow 2, leaving that row in the same situation as the former. After the same manner you proceed, widening always as you go round, and turning still to the left, till the rows become so far asunder, as to make it inconvenient to turn longer in that direction. In general, he has found, that when the rows are placed three feet asunder, about twenty rows may be done after one manner of turning, so as to form, as it were, one ridge; and a proportionally greater number where they are closer. He has only represented six in the diagram, because the circumstances can be as well explained by these as by any greater number, and more easily traced by the reader. When you find it necessary to shift to a new ridge, on account of its width, being returned to the same end from which you began, count the number of furrows you have opened; multiply half the number by three; then, beginning from the point where you stand, set off as many intervals as make up the number you have found; and then mark the row where you stop. In the diagram, the ridge consists of six rows; and as three is the half of six, and three times three make nine, it follows that, passing these nine intervals, you mark the tenth row, which falls on the row *c*, marked on the diagram. Move the plough then from where it stands, as marked by the dotted line and darts, and enter it on the interval on the right-hand side of the row C, and proceed exactly as you did at first, till you open successively the furrows 4, 5, and 6, both going and returning, as marked by the dotted lines and darts in the diagram. There now remains a space of six rows between 3 and 6, which is untouched. Turning the plough still to the left, as before, you open the furrow 7, going upward; but, instead of turning to the left at the top of the ridge, you now turn to the right, and go down the farthest untouched interval, opening the furrow 7 on the return. At the bottom, turn still to the right, and so again at the top, opening up successively the furrows 8 and 9, where you close, turning the earth on both sides towards D, so as to leave it exactly in the same state as a Tullian row would be left after the second hoeing. The plough, when this is finished, comes out at E, whence it may proceed to another. The reader, by beginning at A, and following the dotted lines in the direction of the darts, will be at no loss to trace the progress regularly through the whole.

"It is unnecessary for him, he says, to go farther in this illustration, as the reader will easily perceive that he has only to proceed regularly after the same manner, till he shall have gone over the whole field, and that every subsequent hoeing is performed by directly reversing this; beginning always in the second hoeing where he left off in the first, and leaving off where he began, and making the plough go in a contrary direction; that is to say, it would begin at the bottom in the interval 9, on the right-hand side of the row D, and return downwards in the interval 9, and so on."

It is further stated, that "the reason for reversing the turning in the middle ridge will not, perhaps, be obvious at first sight: it is to augment the breadth of the ridge, without making too much waste in turning at the end; for, by this contrivance, the breadth of the ridge is doubled without any more waste in turning, than if it had been half the breadth. Thus, let us suppose that the extreme breadth is twenty rows, if the turnings had been made all the same way, there would have been a reverse of the operation at every tenth row; but, by proceeding after the manner here described, the work is reversed only at every twentieth row, though the width of turning is no more than before. As the rows, where the work is reversed, must be subjected to all the inconveniences to which the Tullian mode of hoeing is liable, the reader will easily perceive the benefits that accrue from thus diminishing their number. This is, in fact, the only inconvenience to which the mode of horse-hoeing here explained is subject. But if it be considered, that when the rows are at eighteen inches apart (which will easily admit of being well horse-hoed), it will only be every fortieth row, which will suffer this inconvenience; and when it is considered at the same time, that this fortieth row is only in the same predicament, at the worst, with every row that is hoed after the Tullian fashion, the inconvenience will not be found very great."

He notices further, that "the reader, it is to be hoped, will now be satisfied, that it is possible to perform every operation in horse-hoeing by means of the common swing-plough; and further, that these operations can be thus performed in a much more perfect manner than can be done by the aid of the double mould-board plough usually adopted for that purpose. It is more than twenty years since he fell upon this mode of hoeing, nor has he ever employed another since that time; and he can truly say, that he never had reason to be more highly satisfied with any practice in agriculture than this; nor does he think it possible, by any practice that has ever been adopted in the garden or in the field, to rear cabbages, in particular, to so much perfection as in this way; for these plants, rooting firmly, allow the plough very safely to be drawn exceedingly close to the row, while they are young; and the stems, being firm, admit of the earth being laid very close about them as they advance in growth, which can be thus done in a more perfect and economical manner than is, he thinks, possible in any other way. Indeed, he never saw an operation in husbandry that gave him such entire satisfaction, as a field of cabbages done up in this way by an old servant of his, who had, by practice, acquired a perfect knowledge of every step in this process.

The last hoeing, in particular, appeared to strangers, who were passing to be a most extraordinary process; for the plants having reached by that time about three feet in height, reckoning from the bottom of the furrow where the horse went, and the points of the leaves nearly touching each other all along, it seemed as if the horse going through them would break them all to pieces; and the plough being wholly buried among the leaves, did not discover the nature of the operation going forward: and thus it had the appearance of a very unaccountable process. This induced many to stop and look at it; but, when nearly examined, the rich mellow freshness of the mould stirred to so great a depth, and the neatness with which it was laid up to both sides, afforded a degree of satisfaction that few could find words to express. The roots of the plants, being thus at liberty to run in a bed of fresh stirred mould in the highest tilth, being totally freed from the danger of suffering in the smallest degree from hurtful wet on the one hand, or from drought on the other, and this fine mould being genially moist by the absorption and overshading of the leaves, the plants advanced with a degree of luxuriance that he never saw in any other situation. About one week after they had received the last hoeing, they appeared perhaps to the greatest advantage. The mould was yet quite fresh after being so lately turned up; the leaves had entirely closed above the interval, which consisted of a wide and deep furrow so closely overshaded, that there was scarcely the *germ* of a weed to be seen in this furrow: a little person, by stooping, might have walked from end to end of the ridge entirely under cover; while there was not a leaf to be seen in the whole field, that did not display the highest degree of luxuriance. The cabbages, in this case, were of the large winter kind, called in Scotland the drum-head cabbages, from their great size and flatness, being sometimes fifteen or sixteen inches diameter in the cabbaged part. The rows were three feet apart, and the plants two feet three inches asunder in the row."

It is still further remarked, that, "as it is of great great utility in this sort of crop to have the first hoeing as near to the plants as possible, and as they are then very small, and liable to be smothered by any earth that may fall to the left-hand side of the plough, he found it a considerable improvement to adopt a very simple contrivance to obviate that evil: this was to fix a piece of milled iron-plate to the coulter, allowing the other side of it to lean upon the right-hand side of the sheath, so as to close up the opening between the coulter and the sheath. To do this neatly, a thin slip of iron should, he says, be welded on one side to the edge of the coulter, leaving it open behind, like a feather, as is represented at *fig.* 7, in which A represents a section of the coulter B, the thin feather welded to it at the edge, and loose behind; and C, the plate of milled iron, extending to the sheath D, a nail at d; either a screw, the head of which goes quite through the feather, or a clinch nail, secures it to the coulter: one of these nails above, and one below, are quite sufficient for this purpose. The feather prevents the edge of the milled plate from catching the mould, or other obstructions, and thus allows it to cut clean and smooth. By this very simple contrivance, no earth, even in the loosest soil, can, he says, ever be allowed to fall to the left-hand side of the plough. It is, perhaps, scarcely necessary to remark, that the sharper the irons are kept (by which is meant, the less they have been grinded down by using), the more clean and perfect will the operation be, as must be known to every practical farmer; but he has often observed, that if servants be not looked sharply after, they are apt to be extremely negligent in this respect; in consequence of which many operations on the farms of gentlemen of property, who amuse themselves with agricultural pursuits, are performed in a slovenly and imperfect manner, that must disgust them with such operations.

The doctor concludes by observing, that nearly three years ago, happening to be on the farm of Dishley, near Loughborough, in Leicestershire, he informed the nephew and successor to Mr. Bakewell of this method of horse-hoeing, which he immediately adopted; and he has since told him, that it answered so completely, that he considered it as a very great improvement in the mechanical part of agriculture; for which he returned him his warmest acknowledgments. The doctor suggests, that no plant that he knows could be more suited to this mode of culture than the sugar-cane; nor can he conceive any thing that could prove more beneficial to planters in the West Indies, than to indroduce this mode of culture universally among them, wherever the nature of the ground would admit of it. The difference between the tilth that the ground would thus be put into, and that which takes place by the imperfect manual operations to which it is now subjected, would, he conceives, be greater than persons, who have not seen any thing of this kind, can form an idea of, and the crops would be proportionably augmented. He does not think he should be guilty of exaggeration, if he said the produce of the same field, on an average of years, when thus cultivated, would be double what it can be by the other mode of culture: but suppose that it would be augmented only one-fourth, the prospect would be sufficiently encouraging. And, after the ground was once put into good tilth, the expense must, he adds, be greatly below what it now costs. He grounds these expectations on the certainty that the crops would universally be much more luxuriant, that they never could be hurt for want of rain in the driest seasons, that the ground would continue to bear canes for a much greater number of years without being exhausted, than by the present mode of culture; and that the plants, by being laid in the open furrow between the rows (upon a slight covering of manure, where that could be afforded), and covered in by the plough, would not only spring up with more luxuriance, but, as this operation could be performed with very great expedition and little labour, it would admit of getting the plantations finished off quickly during the critical season. To these advantages

might, he says, be added the facility with which rats might be destroyed; for, as the greatest part of the soil would thus be often completely turned up, their nests would be opened, and not only the young be thus destroyed (which cannot be done by the present practice), but the old ones also be liable to be killed by a few well-trained dogs, who might be made to follow the plough for that particular purpose. He is, however, fully aware, that various difficulties would at first oppose themselves to the introduction of the practice, both on account of the want of implements, of persons properly acquainted with the business, and of well-trained horses; but these might be readily obviated by perseverance, in gradually proceeding in the plan.

It is sufficiently clear, however, that notwithstanding the neatness, ease, and facility, with which the business of hoeing may be accomplished by means of ploughs of either the hoe or common sowing kinds, in crops that require large intervals, such as potatoes, beans, cabbages, and others of a similar nature, they are not suited for performing these operations on such as are sown at narrow distances. In these cases, the hoes that accomplish the process on a great number of rows at the same time will be much more expeditious and proper.

Cultivators and scarifiers may also be usefully employed, in many cases, in the early spring months, for loosening and stirring the mould about the roots of these kind of crops.

In the performance of the business of hoeing in general, it has been suggested by some, that this work should be executed as soon as any weeds are discovered to have made their appearance above the surface of the ground, as the doing it once in this state, is much better than twice when they have arrived to some inches in height; as, when hoed in this advanced growth, half of them will soon shoot forth again.

It is remarked by Mr. Amos, in his Treatise on Drill-Husbandry, that in the hoeing of wheat, as it has two kinds of roots, the one called the *seminal*, the other the *coronal* root, the latter seldom appears till the latter end of March, or beginning of April, that is the season for seconding the efforts of nature, by going over the field with a pair of light harrows, which not only destroy the weeds, but also give the coronal roots an earthing up. After the harrowing is finished, the field should be immediately rolled, to press the soil about the roots of the plants, and to prepare for a second hoeing. This last operation may not, however, be necessary, except in such soils as are of the more light kinds.

The same writer adds, that about the beginning of May, or sooner, the second hoeing should be given, either with the six-shared horse-hoe, or the breast-hoe, already described. With the latter, only one row can be hoed at a time; with the former, six or seven rows can be hoed, according to the distance between them. When this hoe is used, the seed-hoppers, &c. should be all taken away, and nothing left but the frame of the drill-machine, to the coulter-bar of which the hoe is fixed. And, in hoeing with this hoe, the horse must go exactly in the same place where it went when drilling the crop, using one hoe less than the number of rows drilled; and that interval between the breadths of the drill-machine should be hoed with the hand, on account of the interval being unequal, from the unsteadiness of the horse; and if the person who attends the machine will keep his eyes continually on one of the hoes, so as to keep it in the middle of the interval, all the rest will be sure to be right. When the person who guides the hoes wants to move them to the right or left, so as to keep them in the middle of the intervals, he should lift up the handles a little when he moves them. And it makes no material difference, whether the hoes or coulters are used or not, as the mode of managing them are equally the same, and the directions given for using the hoes are equally applicable for using the coulters in this hoe.

In regard to the third hoeing, it should, he says, be given the latter end of May, or beginning of June, as, at that time, it greatly invigorates the coronal roots, and promotes the growth of the stems or stalks of the plants. And the fourth hoeing, where it is found necessary, should be given about the latter end of June, or beginning of July, as circumstances may require. But as soils and seasons vary exceedingly, it is impossible, the author observes, to ascertain the precise time when the hoeings should be given. Much must, therefore, depend upon the discretion and judgment of the husbandman; but in no case should weeds be permitted to gain the ascendancy, as by such neglect the crops would be greatly injured.

In the hoeing of wheat by the hand method, in drilled crops, which should, perhaps, only be thus managed, others suppose it should be done as soon after it is up as possible, and by means of two-inch hoes.

In the hoeing of barley, as this sort of grain has likewise two sets of roots, the seminal and coronal, the latter of which forms itself in about three weeks after the grain has been sown, upon the appearance of this root the field should, Mr. Amos thinks, be harrowed, and then rolled for the first hoeing. And the second and third hoeings should be given at proper intervals of time, and should be performed exactly in the same manner as directed for managing the process in the wheat-crop.

And, in the hoeing of oats, the same writer also advises, that, as soon as the coronal roots begin to make their appearance, the field should be harrowed and rolled for the first hoeing. And that the second and third hoeings, where they may be necessary, should be given in due time afterwards, and should be performed in the same manner as directed for hoeing the wheat-crops. The process of hoeing may, however, be accomplished in a very perfect and exact manner, without the necessity of having recourse to the use of hand-hoes at all in any of these sorts of crops, by the horse-hoe invented by Mr. Cook, the method of employing which has been described under the proper head. See *Hoe*.

Others advise, in drilled crops, of both oats and

barley, to hoe as soon as the weeds appear, whether by the horse or hand method. And the hoes in these cases should always be of the same size with the drills, in order that injury may be guarded against. Here the work may often be well performed with one horse attached to an implement that executes four or five rows at a time, being directed by a man by the handles behind.

With regard to the hoeing of beans and peas, Mr. Amos observes, that, as soon as they can be properly distinguished in the rows, they should be rolled and harrowed, which completes the first operation. And that, if the soil be mellow, the expanding-hoe should be used about the middle of May, when the beans will be sufficiently established in the ground, so as not to suffer from the free use of it: the shares should be kept very sharp, to cut the weeds with ease, so that the expanding harrow may bring them more completely to the surface, which finishes the second hoeing. In this situation, they may remain for three or four weeks, or till more weeds appear, when they should be skim-hoed a second time, which completes the third hoeing. In a few days after, the rows should be hand-hoed well, and then earthed up, which finishes the fourth hoeing. In two or three weeks afterwards, they should be hand-weeded, and then earthed up a second time, which completes the number of hoeings that are necessary. But, if the soil should be stiff, gravelly, or stony, the hoe-plough should be used to give the second hoeing, by ploughing a furrow off from the beans on each side, making a ridge in the intervals between the rows; the beans will then stand upon a ridge of about six inches wide, which should be well hand-hoed. In about a week after, the double mould-board plough should be used, to earth up the plants in the rows. In two or three weeks, they should be hand-weeded again; and, as soon as the weeds are dead, they should be earthed up by the double mould-board plough a second time, which finishes the operation of hoeing in such cases.

In the hand-hoeing of these crops, ten-inch hoes are suitable, the earth in the second operation being brought up to the roots of the plants, upon which, in the peas, they should be made to lean so as to be fully exposed to the sun.

In the hoeing of turnips, the first-named author remarks, that as soon as they have got four vigorous rough leaves, they should be harrowed with a pair of light harrows; and, in two or three weeks after, the second hoeing should be given, either by the breast or six-shared horse-hoe, to cut up the weeds in the intervals; and those weeds which are in or near the rows must be cut up by the hand-hoe, and the turnips thinned at the same time. In two or three weeks more, the third hoeing should, he says, be given by the same hoes, the rows being now also well hand-hoed, and the turnips set out singly to their proper distances.

It is added, that what has been here observed, with respect to hoeing turnips, is equally applicable to the hoeing of cole, except the harrowing, which ought to be omitted altogether in such cases.

Some recommend the first hand-hoeing in the early crops to be executed as soon as the leaves spread four inches each way; repeating the work at the distance of about a fortnight, so as to leave them at about twelve inches apart. But, in the latter crops, the nature of the land should be considered, and the distance regulated accordingly; but eight or nine inches are mostly sufficient.

In managing the process of hoeing in carrot-crops, as soon as the carrots are about two or three inches above the ground, they should be harrowed; in which case as many harrows should be tied to a pole as will cover the ridge, and the horses made to walk in the furrows, to prevent treading the land, or injuring the plants. And, in two or three weeks after the harrowing, the second hoeing should be given, to clear the intervals of weeds; and those that are in or near the plants in the rows must be cut up with the hand-hoe, and the carrots thinned at the same time. In this situation, the carrots may remain for two or three weeks, or till more weeds appear. The hoes must then be set to work again, the breast or horse-hoe to clear the intervals, and the hand-hoe the rows; and, if any double carrots are left, they should be removed, and those that are to stand for the crop bent out to their proper distances.

In managing the work with carrot and turnip-crops, the four-inch hoe is preferred by some for the latter, and the three-inch for the former, leaving the plants in the first hoeing at such a distance as may appear necessary; and, in the second, setting them out to that of from three to five or six inches, according to the quality and state of the land.

With respect to the hoeing of potatoes, it is observed by the first writer, that as they are in general planted upon light mellow soils, the expanding horse-hoe is peculiarly adapted to their cultivation. He has cultivated potatoes upon a very large scale, and he never found any instrument equal to it for expedition, and complete execution of hoeing at the least expense. The hoeing of this sort of crop may, however, be performed in a very complete manner by the hoe-plough, or by any common swing-plough, as has been shown above. Mr. Amos advises that, as soon as the potatoes are fairly above ground, they should be harrowed once in a place for the first hoeing; and that, in about two weeks afterwards, they should be skim-hoed for the second hoeing; and, in two or three weeks more, skim-hoed again, observing always to use the expanding-harrow to tear the weeds out of the ground after they have been cut with the hoe. Immediately after this second skim-hoeing, they should be well hand-hoed in the rows; and, as soon as the weeds are dead enough, the plants in the rows be well earthed up, which is done by the same hoe equipped with the mould-boards, as directed in its proper place. See *Hoe*.

As soon as more weeds appear, and before the potatoes spread too much, they should, he thinks, be hand-weeded in the rows, and then earthed up a second time. If any more weeds appear, and are likely to run into seed before the potatoes are taken up, they must be pulled up by hand, and carried off the field, or laid in heaps and burnt, or converted into compost with lime and earth.

In performing this sort of business with this crop, others have recourse to eight or ten-inch hoes, according as the land is more or less stony; in the first hoeing, drawing up the mould to cover the roots, and prevent their rising above the surface; afterwards earthing them up with the mould between the rows.

Respecting the management of hoeing in cabbage-crops, it is remarked, that, as the month of May is the chief season for planting cabbages to stand through the winter, the planting should be finished in that time: and that, in about three or four weeks after they have been planted, the hoe-plough should be introduced, to plough a furrow off from the cabbages on each side, making a ridge in the intervals: the cabbages will then stand upon a flat ridge of six or eight inches broad. These ridges must be well hand-hoed, and the earth drawn up to the cabbages at the same time. After the hand-hoeing is finished, the expanding-harrow may be set to work, in order to harrow the ridge in the intervals, which tears up the weeds, and leaves them on the surface of the land, where they soon die. In about ten or twelve days after being harrowed, the hoe-plough may be set to work again, to plough back the earth to the cabbages on each side of the rows; and, in about two weeks after they have been thus earthed up, the bottom of the intervals should be scoured up, either with the expanding horse-hoe, or the double mould-board plough. This last operation has, it is observed, not only a beneficial, but a most pleasing, effect, and should be repeated a second time as soon as more weeds appear, and before the cabbages spread so much as to prevent the horse from walking in the intervals without injuring them. If any more weeds appear, they may be pulled up by hand; and the caterpillars, when present, killed at the same time that this operation is performed.

The whole business of hoeing in this crop may, however, be pefectly performed either by the hoe-plough, or the common swing-plough, as has been shown above.

In this business, where the hand mode is employed, a three-inch hoe is first had recourse to, and in a fortnight or three weeks afterwards, a four-inch hoe; the plants being afterwards drawn out, and planted so as to afford the distances, which are thought most proper and advantageous under different states of the land.

But though it must often be necessary in the business of cultivation to have recourse to both the horse and hand methods of hoeing, in order to render the crops perfectly clean, and in the most suitable state of growth, it is evident that the former has much superiority over the latter in the economy of labour, as well as in effecting the business in many cases in a much more effectual manner.

The following comparative trials on an acre of ground, under different crops, as potatoes on a light sandy loam, worth about 20*s.* and cabbages on a stiff hazel-coloured loamy soil, of the same value, as stated by an excellent writer on drill-husbandry, show the difference of the methods in a very striking manner.

Potatoe Crop, light sandy Loam.

Horse-hoed Acre. *Dr.*

1789.		£.	s.	d.
Feb. 2,	Ploughing first time	0	5	0
28,	Harrowing	0	0	6
	Dung, twelve loads, and spreading	0	16	0
March 1,	Ploughing second time	0	4	0
April 2,	Harrowing ditto	0	0	6
24,	Ploughing with 3 ploughs	0	4	0
	Planting 12 hands 3 inches deep, 9 asunder, with 30-inch alleys	0	4	0
	Seed and cutting; 30 bushels at 1*s.* 4*d.*	2	0	0
	Rolling	0	0	6
June 1,	Harrowing for first hoeing	0	0	6
10,	Skim-hoeing first time	0	1	0
	Hand-hoeing the rows	0	3	0
26,	Skim-ditto, second time	0	1	0
	Hand ditto rows	0	3	6
July 1-15,	Earthing up rows twice	0	2	0
Aug. 2,	Picking out weeds	0	1	6
Oct. 20,	Taking up, pying, &c.	1	16	0
	Expenses	£6	3	0
Contra.		*Cr.*		
	Produce, 500 bushels, at 8*d.*	16	13	4
	Profit	£. 10	10	4

Hand-hoed Acre. *Dr.*

1789.		£.	s.	d.
Jan. 12,	Ploughing first time	0	5	0
Feb. 24,	Drag-harrowing	0	1	0
	Dung, twelve loads, half charged, spreading, &c.	0	16	0
March 2,	Ploughing second time	0	4	0
30,	Harrowing twice	0	1	0
April 24,	Ploughing with 3 ploughs	0	4	0
	Planting 12 hands 3 inches deep, 8 asunder, 24-inch alleys	0	4	6
	Seed and cutting, thirty-six bushels, at 1*s.* 4*d.*	2	8	0
June 1,	Harrowing for first hoeing	0	0	6
14,	Hand-hoeing first time	0	5	0
26,	Second ditto	0	4	0
July 6,	Earthing up	0	15	0
Aug. 3,	Picking weeds	0	1	6
	Taking up, leading, pying, &c.	1	14	0
	Expenses	£7	3	6
Contra.		*Cr.*		
	Produce, 420 bushels, at 8*d*	14	0	0
	Profit	6	16	6
	Advantage in favour of horse-hoed acre	3	13	10
		£10	10	4

Cabbage Crop, one Acre stiff hazle Loam.

Horse-hoed Acre. Dr.

1790.		£.	s.	d.
Jan. 14,	Ploughing - -	0	5	0
Feb. 20,	Harrowing twice -	0	1	0
Mar. 11,	Dung, twelve loads, half charged, at 3*s*. - -	0	18	0
14,	Ploughing second time -	0	4	0
April 20,	Drag-harrowing and couching	0	3	6
May 14,	Ploughing into four-feet lands	0	4	0
	Five thousand plants, at 2*s*. 6*d*.	0	12	6
	Planting 48 by 30 inches	0	8	6
June 10,	Ploughing from rows -	0	2	6
	Hand-hoeing and hilling -	0	3	6
July 1,	Ploughing to rows -	0	2	6
20,	Earthing up by horse-hoe	0	1	6
Aug. 1,	Hand-weeding and vermin-killing - - -	0	1	6
	Rent, &c. - -	1	1	0
		£4	9	0

Contra. Cr.

Dec. 21,	Value of produce, 50 tons	10	0	0
	Profit	£5	11	0

Hand-hoed Acre. Dr.

1790.		£.	s.	d.
Jan. 15,	Ploughing - -	0	5	0
Feb. 21,	Harrowing twice -	0	1	0
Mar. 11,	Dung, - -	0	11	0
14,	Ploughing second time -	0	4	6
April 20,	Dragging, harrowing, and couching - -	0	4	0
May 12,	Ploughing third time -	0	4	0
	Plants, 5,500 - -	0	13	9
	Planting 36 by 30 inches	0	10	6
June 10,	Hand-hoeing and earthing up	0	12	0
July 20,	Ditto second time -	0	7	6
Aug. 1,	Hand-weeding, &c. -	0	2	6
	Rent - - -	1	1	0
		4	16	9

Contra. Cr.

Dec. 21,	Produce, 41 tons -	8	4	0
	Profit -	3	7	3
	Advantage in favour of horse-hoed acre - - -	2	3	9
		£5	11	0

And the expeditious and effectual manner in which the work is performed in this way, shows that it must have an equal degree of superiority in other sorts of crops.

The particular application of the different methods in the culture of different descriptions of crops will be more fully noticed under their proper heads, in considering the management which is necessary in their growth.

HOG, a name generally applied to animals of the swine kind. These are a sort of live-stock that are of considerable profit and advantage on particular descriptions of farms, such as those of the arable and dairy kinds. And on those of almost any sort, a few may be kept with benefit, as they prevent the waste of various kinds of refuse materials, that can only be used for such purposes. Hogs may also be kept with much profit in various kinds of manufactories, where large quantities of grain are made use of; as in those of starch, &c. and in distilleries and breweries. It is a matter of much consequence for the farmer to have a good breed of hogs, so as to suit the nature of his farm, and the means he possesses of procuring keep for them. See *Swine*.

Hog-*Cistern*, a cistern constructed for the purpose of containing the food that is necessary for the feeding of hogs or swine. It should be built in as convenient a situation as possible for the dairy, kitchen, and hog-yard, and so as that no loss may be sustained by its leaking, or letting out the more liquid matters. It is observed by Mr. Marshall, in the Rural Economy of Norfolk, that "hog-cisterns, in that county, are principally built with bricks and terrace. But this is expensive: yet a hog-cistern is among the first conveniences of a farm-house. Wooden vessels are, he says, incommodious, and leaden ones dangerous. This summer, he remarks, a receptacle for water in a brick-yard being wanted, he had one built of bricks, laid in clay, and surrounded with a coat of the same material. It held water perfectly. Afterwards he built a hog-cistern in the same manner. This morning, on inquiry, he found, he says, that not only the tenant, but his wife and her maids, are fully satisfied with it. It was built in the following manner: A pit, five-feet and a half long, by four-feet wide, and five feet deep, was sunk in the place most convenient to the dairy, kitchen, and hog-yard, jointly. The bottom of the pit was bedded with some extraordinarily fine clay, fetched from the sea-coast for this purpose, moistened and rammed down; and its surface smoothed over with a trowel. On this flooring were laid three courses of bricks in clay-mortar (the best of the clay being taken for this purpose), and in such a manner, that the joints of one course fell in the middle of the bricks of the course below; the whole being laid longways; not crossed in the usual manner. The sides were carried up half a brick thick (that is, a brick in width), with mortar of fine clay; and, in a vacancy left between the brick-work and the sides of the pit, moist clay was firmly rammed; so as to unite as much as possible the bricks, the clay, and the sides of the pit,

into one solid mass; carrying the brick and clay-work up together; and beating back such bricks, into the clay, as were forced forward by ramming. The cistern, when brought up level with the surface of the ground, measured three feet long, two and a half feet deep; consequently the surrounding seam of clay was not more than four inches thick; and the stratum, at the bottom, about the same thickness. Above ground, a nine-inch wall was raised on each side, two feet high, with a gable carried up at one end; and, on these, a span or pitched roof was set, and covered with tiles; the other end being left entirely open, as a door-way." It is observed, that "this is an admirable covering for a cistern. A flap, whether it lie horizontally or sloping, being continually exposed to the weather, lets in rain-water, soon rots, and, from the manner in which it hangs, is liable every day to be split, and its hinges forced off, by the heedlessness of the servants; whereas a door, having only a gentle fall, and being always under cover, will last a number of years." Where large stocks of hogs are kept, there ought to be several different cisterns of this sort, in order to have the food properly prepared, and in due quantities. Besides, they admit of mixing the food more conveniently.

Hog's *Hair*, the bristly hair scraped from the hogs when killed, which is sometimes, when it can be procured in sufficient quantity, made use of as a manure. In London, it is occasionally bought at about nine shillings the quarter, a ten-bushel sack stuffed quite full, and which is applied so as to be turned in just before the crops are sown, in which method it succeeds well on the lighter sorts of land. And seal hair is a material that may be used in a similar manner.

Hog-*Manure*, that sort which is raised by the hogs in their sties, yards, and other places; and which is found to be a very powerful sort of manure; by some, supposed nearly equal to that of the stable kind. Others, however, suppose that weeds are more apt to rise after the use of this sort of manure, than that of some other sorts. See *Manure*.

Hog-*Sty*, a building or house constructed for the purpose of containing hogs or swine. Houses of this kind are mostly made in a simple manner, requiring only warm dry places for the swine to lie in, with small areas before, and troughs to hold their food. They are generally constructed with shed-roofs, and seldom above six or seven feet wide, with height in proportion. In order that they may be convenient, they should be at no great distance from the house; and the less they are connected with the other farm-buildings the better. In some cases, it might be of utility to have them connected with the scullery, in such a way as that all sorts of refuse articles might be readily conveyed to them by pipes or other contrivances. When at a distance, they should be so placed as that the servants need not enter the farm-yard in feeding them. It is a circumstance of vast advantage in the economy of labour, as well as food, to have them conveniently situated and built.

Though swine are generally, perhaps from a too partial view of their habits, considered as filthy animals, there are no animals which delight more in a clean and comfortable place to lie down in, and none that cleanliness has a better effect upon with respect to their thriving and feeding. In order to keep them dry, a sufficient slope must be given, not only to the inside places where they are to lie, but to the outside areas, with proper drains to carry off all moisture. The outsides should also be a little elevated, and have steps up from the areas of at least five or six inches in height. Hog-sties should likewise have several divisions, to keep the different sorts of swine separate; nor should a great many ever be allowed to go together; for it is found that they feed better in small numbers, and of equal size, than when many are put together of different sizes. Proper divisions must, therefore, be made; some for swine when with the boar; others for brood swine, and for them to farrow in; for weaning the pigs, for keeping the store-pigs, for fattening, &c. When convenient, the areas should be pretty large. And where it can be had, it is of great use to have water conveyed to them, as it serves many useful purposes.

Mr. Marshall, in his Minutes of Agriculture, observes, that every sty should have a rubbing-post. "Having occasion," says he, "to shift two hogs out of a sty without one, into another with a post, accidentally put up to support the roof, he had a full opportunity of observing its use. The animals, when they went in, were dirty, with broken ragged coats, and with dull heavy countenances. In a few days, they cleared away their coats, cleaned their skins, and became sleeky haired; the enjoyments of the post were discernable even in their looks, in their liveliness, and apparent contentment. It is not probable, that any animal should thrive while afflicted with pain or uneasiness. Graziers suffer single trees to grow, or put up dead posts in the ground, for their cattle to rub themselves against; yet it is probable a rubbing-post has never been placed intentionally in a sty; though, perhaps, for a two-fold reason, rubbing is most requisite to swine."

It is difficult to suggest any form that can be generally applicable in constructing buildings of this sort, as they must constantly be regulated by the nature of the situation, and other circumstances. It is, however, supposed by Mr. Young, that "a piggery, when on an extensive scale, must be in a circle, or it must fail in convenience. In the centre, the boiling or steaming-house, with a granary for corn, meal, bran, &c. a range of cisterns in divisions around it, for receiving immediately from the copper or steam apparatus, and also by tubes from the dairy; around these a path, then the fence, wall, or paling, in which the troughs with hanging lids, for supplying food directly from the cisterns, on one side, and for the hogs feeding on the other; a range of yards next, and another of low sheds beyond, and, last of all, the receptacle for the dung. The potatoe stores (pyes as they are called) should at one end point near to the entrance, and water must be raised to the coppers

and cisterns at once by a pump; a trough or other conveyance from the dairy to the cisterns, for milk, whey, &c. Such an arrangement will be very convenient, and the expense need not be considerable. To annex a certain space of grass, or artificial grasses, in divisions, into which the hogs may be let at pleasure, is an addition, he says, of admirable use, if the spot permit it. Those who do not possess a convenient pig apparatus, can have little idea of the great use of it, in making manure. This alone becomes an object that would justify any good farmer in going to a certain expense, for attaining so profitable a part of what ought to be his farm-yard system. In nine-tenths of the farmeries in the kingdom, it is, he thinks, lamentable to see so many parts of a right piggery scattered and unconnected, in such a manner as to preclude convenience, increase labour, and prevent the making of dung."

It is added, that "in 1765, he built a hoggery, nearly, but not exactly, on this idea, the expenses of which were as below:

EXPENSES.

The boiling-house	£.18	18	0
Copper	13	0	0
Pond	4	0	0
Pump	1	10	0
Cisterns	14	0	0
Shed	6	15	0
Paling	7	7	0
Paving	10	0	0
Troughs	3	0	0
Total, besides timber	£.78	10	0

He further states, that "by means of one of these yards, he fattened 88 hogs in spring 1766, with only one man to attend them; whereas three would not have been sufficient without such conveniences. They were littered with nine loads of straw and haulm, that cost 6*l.* 18*s.*; and this made 90 loads of very rich dung, valued by several farmers on the spot at 5*s.* a load.

Value of dung, at that rate	£.23	10	0
Straw, &c.	6	18	0
Profit in dung	£.15	12	0

But, says he, "they had not half the litter they ought; they would have made 35*l.* worth of manure, beyond doubt. Ninety loads costing 6*l.* 18*s.* is 1*s.* 6*d.* per load."

He conceives, that "these particulars surely must prove the vast importance of such conveniences for fattening great numbers of swine, for the mere purpose of raising manure. Suppose, says he, the expense, timber included, to be 110*l.* and the interest called 5*l.* what comparison is there between the expense of 5*l.* a year, and the prodigious utility of having it always in your power to fatten, with scarce any expense of labour, whatever number of hogs you please? With such a convenience, all the peas, beans, barley, buck-wheat, potatoes, parsnips, carrots, &c. that are, or can be raised on a farm, may be applied to the rearing, feeding, or fattening hogs; by which means the farmer has the opportunity of improving his land to the highest degree, and at the cheapest rate possible."

He concludes, that "the total expense at present of such yards would not be less than 150*l.* And, if made conformably to the more correct idea, would be 200*l.* or 250*l.* But the governing idea of position should be followed in sties of 20*l.*"

But other forms, in many cases, may be had recourse to with great propriety.

Hog-*Trough*, a sort of open box, or other contrivance, for containing the food of swine, while it is eaten. Troughs of this kind are constructed in different ways, and of different sorts of materials, according to circumstances; but wood and stone are the most common. It is observed by Mr. Beatson, in the first volume of Communications to the Board, that swine are apt to spill and waste a great deal of their meat by getting their feet among it, unless proper precautions are taken to prevent them. This may be done by making a rail or covering of thin deal slope from the back part of the trough towards the fore part, as in *fig.* 3, *pl.* XIV. leaving just room enough to admit their heads. There should also be divisions across the troughs, according to the number of swine, to prevent the strongest driving away the weakest. These divisions need not extend to the bottom of the troughs; but should rise a little higher than the top, and may be made of pieces of board, about eight or ten inches broad, as represented in *figs.* 4, 5, and 6.

And another way to prevent them wasting their food would be, he says, to have shallow wooden troughs placed about a foot from the ground; above them, large deep troughs, open at bottom, and placed as shown in the section *fig.* 7. In the upper trough, the meat is put, but no more can get down than what rests in the bottom of the shallow trough; and, when that is eaten up, a fresh supply will always succeed from the upper trough. But, for food of a liquid nature, as milk, whey, &c. there may be a stone trough below, as at a, and spars or holes in the bottom of the shallow trough to let it pass through. Troughs of this kind may be made to serve two divisions at the same time, by being placed betwixt them.

It is likewise suggested, that a small stream of water running through a sty in an open spout, so that the pigs might easily get at it to drink, would be of great service.

Hog-*Weed*, provincially a name applied to kot-grass.

Hog-*Sheep*, a term applied to the male or wedder sheep, of one year old, from the time of weaning to that of the first shearing.

HOGGEREL, a term signifying the same.

HOGGIT, another term implying the male or wether sheep, from the time of taking from the ewe to one year old.

HOLCUS, soft grass; a genus of grasses of which

but few of the species made use of for the purposes of the farmer.

Holcus *Lanatus*, meadow soft grass. This, Mr. Curtis remarks, is a very common grass in all meadows and pastures; also in waste ground, and woods newly cut down; and that it is hardy and productive of foliage, flowers a month later than the *anthoxanthum*, and, when its red pannicle appears, the farmers consider their grass fit for mowing.

Its foliage is soft and woolly, which, if not disliked by cattle on that account, may, he thinks, rank with some of the best grasses: if it were more early, it would, however, be more valuable. Mr. Sole does not, however, seem to think so favourably of it as from its particular softness: he cannot conceive it excellent either for pasture or hay. This is the grass known by the title of Yorkshire white.

Holcus *Mollis*, creeping soft grass. Mr. Curtis, in his Tract on Grasses, observes, that he is induced to think better of this grass now than when he figured and described it in his *Flora Londinensis*, having found that it will grow well in a sandy soil, and bear the drought of summer better than most others. Captain Dorset, he adds, is of opinion, that it may even be cultivated advantageously in barren sandy soils.

HOLD, a term applied to animals, which, after being covered by the males, are said to hold.

HOLL, a term provincially signifying the hollow of the ditch, in contradistinction to the dick or bank of it.

HOLLY, a tree of the evergreen kind. On good, dry, loamy soils, it grows to a considerable size; but, on poor or wet soils, seldom becomes more than a low shrubby plant. A writer in the Bath Memoirs remarks, that it makes an impenetrable fence, and bears cropping. Sheep, says he, are fed in the winter with the croppings, and birds eat the berries. The bark fermented, and then washed from the woody fibres, makes the common bird-lime. The beauty of its scarlet berries never, he asserts, suffers from the severest of our winters. The wood is excellent for veneering, and is sometimes stained black to imitate ebony. Handles for knives, and coggs for mill-wheels, are made of it. It is often provincially termed *hollin*.

It is remarked by Mr. Young, that "no plant makes so good a hedge as holly; if preserved with any attention in its infancy, it will, in a few years, be impenetrable to man or beast. It often fails from being planted at an improper season; for there is not the least certainty of any success, except by planting about Midsummer. The plants should be from six to nine inches high, and well rooted: they should not be let into the sloping face of a bank, but on a level tablet left for that purpose, and well defended on both sides, to keep both sheep and hogs from it."

HOLM, a term applied to a low track of land on the side of a river.

Holm-*Land*, that sort of rich land, which is situated along the sides of rivers, and which has probably been gradually formed by depositions from them. They are mostly well adapted for the growing of grass; and, when broken up, are found to produce heavy crops of most sorts of grain. From their being, in most cases, liable to be flooded, they are, however, more proper for being kept under the first system of husbandry.

HOLT, a lameness in the feet of animals.

HOME-*Breeds*, a term usually applied to such cattle stock as are bred in the particular district.

Home-*Stall*, the site of the farm-house and buildings. It is obvious, that farms are of more or less value, according to the means of occupying them. And it is observed by Mr. Marshall, that arable lands, in particular, require buildings, and other conveniences, proportioned to the size of a farm. We frequently see tenants curbed in their operations, and incurring a waste of produce, through the want of sufficient home-stalls. On the other hand, we sometimes observe a prodigality of expenditure on farm-buildings: thus not only sinking money unnecessarily, but incurring unnecessary expenses in subsequent repairs, by extending homesteads beyond the sizes of farms. See *Farm-Yard*.

Home-*Stead*, the site or ground where the farm-buildings and offices are erected.

HONEY, a well-known sweet substance elaborated by the bee. In order to have plenty of honey, where bees are kept, there should be abundance of flowers proper for the purpose cultivated. See *Bee*.

Honey-*Dew*, a clammy sweet matter, often observed covering the leaves and other parts of various sorts of trees and plants, at particular seasons. The cause of it seems not yet well understood, as it has not been fully ascertained whether it proceeds from external causes, or depends on some morbid condition of the vegetables themselves. Dr. Darwin is inclined to the latter opinion, and believes it to be an excretion from the plants that are subject to it.

Honey-*Grass*, a sort of grass sometimes found in shady situations, but of little use as food for animals. See *Mellica*.

Honey-*Suckle Clover*, a term applied provincially to white clover.

HOODS, the covering sheaves of shocks of corn.

Hood-*Sheaves*, the covering sheaves of grain hattocks.

HOOF, the horny part of the foot of a horse, or other animal, that appears when set to the ground. The hoof of a horse should be of a figure nearly round, and not elongated towards the heel. The horn of the hoof should also be solid, tough, high, smooth, without any circles, somewhat shining, and of a dark colour. This sort of horny substance constitutes the feet in most kinds of animals of the quadruped tribe. The hoofs of all sorts of animals, when ground or broken down by mills or other contrivances, have been found extremely powerful and lasting in their effects as manure. See *Manure*.

Hoof *of a Horse*, in *farriery*, the part which forms the foot. It consists of the wall or crust, the frog and the bars. The upper part, where the crust is attached to the skin, is termed the coronet; the lower part, in front, the toe; the sides are termed quarters; these terminate in the heels, which are

connected with the frog. The crust, in proceeding from the coronet, takes an oblique direction downwards; by which means, the hoof acquires a somewhat conical shape, having considerably more width at the basis than at the coronet. This, however, is only the case in the natural or healthy foot, which has not been subject to improper management in shoeing; as, where the bars have been pared away, and the frog so reduced as to be incapable of receiving pressure, the heels contract and approach each other, and the form of the foot suffers considerable alteration. See *Frog*.

Bony Hoof, in *farriery*, a bony swelling upon the top of a horse's hoof. It is mostly caused by some blow or hurt, or by being bruised in the stable. The cure may be effected by rubbing the part with some discutient ointment, or by simply rubbing mercurial ointment on the part.

Brittle Hoof, in *farriery*, a disease in the hoof of horses, arising from their becoming too dry. In this case, the best remedy is that of keeping the feet moist by proper stuffings, and not too hot in the stable.

Contracted Hoof, in *farriery*, a disease in the feet of horses, arising from the contraction of the horny substance that constitutes the hoof. It is mostly attended with an increase in the thickness of the sole. Mr. White, in his Compendium of the Veterinary Art, observes, that the cavity of the hoof being thus diminished, the sensible foot suffers a greater or less degree of compression, which occasions in it inflammation and lameness. When we examine, says he, the bottom of a contracted foot, instead of being circular, it will be found of an oblong form; the heels and frog will appear as if they had been squeezed together in a vice. Sometimes the frog has become rotten, and discharges an offensive matter.

It is added, that the sensible frog may also be compressed and inflamed by an increased thickness, and a consequent loss of elasticity in the hoof and sole; and, in this case, there is seldom any considerable alteration observed in the external form of the foot. And we sometimes, he asserts, meet with horses that go perfectly sound, though their hoofs are much contracted; while, on the other hand, we often see severe lameness produced by a slight degree of contraction.

In attempting to cure this disease, the first step to be taken is, he conceives, to remove carefully with a knife all the rotten parts of the frog, and apply tar to those which are sound; a small quantity should also be poured into the cleft of the frog: this will promote the secretion of horny matter; and, if assisted by pressure, will increase the solidity of that which is already formed.

The quarters and heels are then to be rasped, particularly at the coronet, and the superfluous parts of the sole removed with a butteris and drawing-knife. The toe is to be shortened as much as can be conveniently done. And if the heels are too high, that is, if the crust at the heel is too deep, it will be necessary to reduce it with the butteris and rasp. It frequently happens, however, in feet of this description, that the heels are too low: in such cases, they must be carefully preserved; and, when a shoe is applied, it should be made thicker at the heel than at the toe, and somewhat longer than that recommended for a sound foot.

The contracted hoof having been thus treated, the next thing to be done is, he says, to keep the foot as moist as possible, and expose the frog constantly to pressure, either by means of the artificial frog, or by reducing the crust at the heels. When these remedies have been persevered in for a short time, the frog will have acquired a certain degree of hardness and solidity; it will then be proper to turn the horse out into some soft meadow-ground, without shoes, taking care that the bottom of the foot is occasionally reduced, so that the frog may constantly receive pressure. If the foot is examined after a short time, it will be found, he observes, that all the new-formed hoof at the quarters and heels, that is, all the horn that has been produced at those parts since the remedies were first employed, instead of growing down nearly in a perpendicular direction, or obliquely inward, is forced outward in its descent; so that the cavity of the hoof will be considerably enlarged, and the compression of the internal parts removed.

After the horse has been at grass a sufficient time for the new hoof to grow completely down, the shape of the foot will be found much altered; the heels, instead of being narrow, will be open and expanded, the frog will be considerably widened, and not squeezed together as before, and the oblong form will be changed to one that is more circular: in short, where the frog, during this time, has been properly exposed to pressure, and the quarters so rasped as to be rendered sufficiently flexible, the hoof will be found very similar in its form to that of a colt, or other young horse.

It is further remarked, that, in cases where a contraction of the hoof has already produced inflammation and lameness, particularly if the lameness is not recent, it will be advisable to blister the pasterns previous to turning the horse out; and, when the inflammation is very considerable, a laxative ball, with a cooling diet, will be serviceable. The cruel operation of drawing or tearing off the sole has been recommended as a remedy for contracted feet; but very little reflection will convince any one of its inefficacy. Whenever it has been supposed to do good, the benefit has probably arisen from the long run at grass, that becomes necessary after it; and then the advantage might have been equal, perhaps greater, had the operation been omitted. It has been observed before, he says, that, in contracted hoofs, there is generally an increased concavity in the sole; whence we may reasonably conclude, that it opposes the contracting powers, though, in the end, it is not capable of preventing the contraction from taking place.

Upon a horse that has been lame from this disease a considerable time, it is difficult, he thinks, if not impossible, to perform a radical cure: in such cases,

he has several times succeeded in removing the lameness; but the internal parts had become so irritable, or their organization had been so altered, that very moderate work would cause the lameness to return. When the lameness is not so considerable as to render the horse totally unfit for work, it will be advisable to apply a shoe that is thicker, wider, and longer at the heels, than that recommended for a sound foot; and, if the frog is tender and rotten, the bar-shoe will be found serviceable. It will be useful, also, to keep the hoof as moist as possible, by making the horse stand in wet clay four or five hours during the day-time. See *Shoeing of Horses.*

It is added, that, in examining the feet of horses, after death, that have been thus diseased, we find, generally, that the *laminæ* have been destroyed, the coffin-bone injured, and the lateral cartilages ossified. In some cases, however, no appearance of disease can be perceived on the internal parts of the foot. Where the disease has gone so far as to injure the laminæ, cartilages, or coffin-bone, there is not a possibility, he supposes, of removing it; which shows how necessary it is to attend to the feet of horses more than is commonly done; and that, whenever any alteration is perceived to be going on in the shape of the foot, when the heels appear to be getting narrower, the frog squeezed together, and discharging matter, in consequence of the compression which the sensible frog suffers, it surely must be of importance to adopt such measures as will not only prevent the disease from going any further, but will also restore the foot to its natural healthy state; for, when it has gone so far as to produce absolute lameness, the cure is by no means certain. How frequently, says he, do we meet with horses that are said to be tender in the feet, and how subject are they to fall in consequence of this tenderness, which generally arises from contraction of the crust. In this case, the sensible frog is extremely irritable and inflamed; and the horny frog, which nature designed for its protection, being soft or rotten, and inadequate to its function, every blow that it receives must of course give the animal very considerable pain; and he has known many valuable horses thrown down in this way, since, however high and wide the heel of the shoe may be, the frog will be subject to occasional blows from sharp projecting stones. Whenever, therefore, any of those symptoms make their appearance, and whenever the foot seems to be undergoing an alteration in form, immediate recourse should be had, he thinks, to the means of prevention, which he has just pointed out.

Hoof-*Bound*, in *farriery*, is a shrinking of the hoof at the top and the heel, which makes the skin start above the hoof, and grow over it. It may happen either by keeping horses too dry in the stable, straight shoeing, or keeping the feet too hot in the stall.

Hoof-*Cast*, in *farriery*, a term applied to the hoof, when the coffin falls clean away from a horse's foot.

Hoof-*Loosened*, in *farriery*, is an infirmity in a horse's foot, in which there is a dividing of the horn or coffin of the hoof from the flesh at the setting on of the coronet.

Hoof-*Swelled*, in *farriery*, an infirmity that sometimes happens to young horses by being over-ridden, or too hard worked, and which, if not speedily removed, may beget a wet spavin. It may, in general, be removed by an application of some emollient ointment, such as marsh-mallows, &c.

HOOP, provincially a sort of cheese-vat.

Hoop, a dry measure of grain, which is equal to a peck, or a quarter of a bushel.

HOOSE, in *farriery*, a sort of affection of the lungs, to which cows and some other animals are liable. In the cure, Downing advises the following:

Take vinegar of squills, one ounce; balsam of capivi, one ounce; balsam of sulphur, two ounces; honey, four ounces:

Mix these, for one dose, in a quart of penny-royal tea, and give it to the beast, fasting two hours before, and two hours after. The dose to be repeated every third day. Or,

Take elecampane, two ounces; salt of wormwood, one ounce; liquorice powder, one ounce; sweet spirits of nitre, one ounce; Æthiop's mineral, half an ounce:

Mix these as before, and repeat it every twenty-four hours.

The beast should be kept in the house while taking these medicines, unless the weather is particularly fine, and the grass dry: avoid giving it cold water.

HOP, a well-known plant of the climbing kind, which is principally cultivated for the bud and flower, which are made use of for the bittering of beer, and other malt-liquors.

It is observed by the author of Modern Agriculture, that there is supposed to be only one species of the hop-plant, although there is known to be several varieties, and these, when in flower, of different colours, as red, green, and white. The first is, he says, best adapted to cold unfavourable climates, being more hardy than the others; but the green, notwithstanding it is less hardy than the red, is more productive; and the white, which is still more delicate and tender, is the most valuable, as, besides being the earliest, the produce also sells the highest at market.

The writer of the Synopsis of Husbandry distinguishes them under the titles of the Flemish, the Canterbury, the Goldings, the Farnham, &c. and says, that the Flemish is held in the lowest estimation of any. It is, says he, of a smaller size, of a much closer contexture, and of a darker green colour than any of the rest, and grows on a red bind; and has so near an affinity to the wild or hedge-hop, that it would never answer for cultivation, did it not possess the property of resisting the blast with greater vigour than the other kinds; so that, in years when these last are covered with flies and lice, the Flemish hop appears strong and healthy. At picking time, likewise, this kind of hop, he says, takes less damage, either by the sun or rains, than any other; and, upon these accounts, it may answer the views of the planter to have a few acres of

it, which will secure him a crop in a blasting season, when those of the more valuable class are destroyed, so as to be worth nothing.

And the first-mentioned author adds, that as these different varieties of hops become ripe at different periods, the hop-planters are extremely cautious not to mix several varieties promiscuously in the same ground; while, for the same reason, the farmers find it materially for their interest to have several sorts planted, either in separate grounds, or detached from each other, in the same ground. Without this precaution, continues he, the picking, drying, &c. of an abundant crop would require a greater number of hands than could be easily procured. Whereas, when the crop becomes ripe at different periods, the work goes on with more regularity, and the requisite number of hands is more easily procured for the purpose. Hops are likewise further distinguished into male and female; and as the latter sort only produce fruit, the former are extirpated with the other weeds as useless.

It has been observed, that the soils most favourable to the growth of hops are clays and strong deep loams; but it is also of great importance that the sub-soil should be dry and friable, a cold, wet, tenacious, clayey, under-stratum being found extremely injurious to the roots of the plants; as, when they penetrate below the good soil, they soon become unproductive, and ultimately decay. Mr. Bannister says, that a chalky soil is, of all others, the most inimical to the growth of this vegetable; the reason of which he takes to arise from the dry and parching quality of the chalk, by which the roots are prevented from absorbing a quantity of moisture, equal to the supply of the vine with sap during its growth; for though a dripping summer is by no means kindly to the welfare of the hop, yet since the vine in a healthy state is very luxuriant, and furnished with a large abundance of branches, leaves, fruit, &c. it follows that the demand of moisture from the soil must be proportionably great to preserve the plant in health and vigour; and for this reason the ground ought not to be deficient in natural humidity. Hence we generally find the most luxuriant bind growing on such land as is deep and rich, as moulds, &c.; and in these grounds it is common, he says, to grow a load on an aere. But it is to be observed, however, that the abundance of fruit is not always in proportion to the length of the vines; since those soils, which from their fertility cause a large growth of bind, are more frequently attacked with the blast than land of a shallower staple, where the bind is weaker and less luxuriant.

But though it has been mentioned, that rich moulds generally produce a larger growth of hops than other soils, there is one exception to this rule, where the growth is frequently eighteen or twenty hundred per acre. This is on the rocks in the neighbourhood of Maidstone, in Kent, a kind of slaty ground, with an under-stratum of stone. On these rocks there is a large extent of hop-garden, where the vines run up to the tops of the longest poles, and the increase is equal to that on the most fertile soil of any kind.

Mr. Donaldson thinks the most desirable situation for a hop-plantation is ground sloping gently towards the south or south-west, and screened, by means of high grounds or forest-trees, from the north and north-east. At the same time, it ought not to be so confined as to prevent that free circulation of air which is indispensably necessary where plants grow so close together, and to such a height. A free circulation of air, in a hop-ground, he remarks, not only conduces to the health and vigour of the plants, but also prevents the crops from being blighted, or what the hop-farmers call *fire-blasted*, which often happens towards the middle of a large close-planted hop-ground; while the outsides, in consequence of the more free circulation of air that there takes place, receive no injury whatever.

Mr. Bannister asserts, that those fields that lie within a few miles of the sea, or in the neighbourhood of marshy or fenny levels, are seldom favourable to the growth of hops, as such grounds generally miscarry in a blasting year; and though, from the fertility of the soil, they may perhaps bring a plentiful crop in those seasons when the growth is general, such situation is by no means an eligible spot for a hop-ground.

And the former of the above writers says, that in forming a hop-ground, that is, in preparing th land previously to planting, considerable attention is necessary, by fallowing, or otherwise, to destroy the weeds, and to reduce the soil to as pulverised a state as possible. The ridges should also, he thinks, be made level, and dung applied with a liberal hand.

It is remarked further, that when it is proposed to keep the hop-ground clean by means of ploughing, the plants are set in equidistant rows; but that when the farmer proposes to extirpate the weeds by manual labour, the form in which the plants are arranged is not considered of so much importance, provided sufficient room be allowed between each plant, or rather each hill, and which in no case should, he conceives, be under nine or ten feet from the centre of the one to the centre of the other.

The author of the Synopsis of Husbandry, however, says that "hops are usually planted in rows, making the hills six feet distant from each other; though there are some people who, from avaricious motives, prefer a five-feet plant. But as this vegetable, when advanced in growth, produces a large redundancy of bind and leaves, it should seem that six feet cannot be too wide a distance; and that those which are planted closer will, from too confined a situation, be prevented from enjoying a free circulation of the air; from which much injury may proceed, as blasts, mildews, mould, and other accidents, not to mention the disposition of the bind to house or grow together at the tops of the poles, whereby the hops are so overshadowed as to be debarred the influence of the sun, and thus not arrive to half their growth."

From these considerations it appears, he thinks, that "this vegetable cannot be planted with any probability of success at a closer distance than six feet; and perhaps if the hills were made to stand seven feet asunder, the crop would in general be larger, especially on good land, where the bind is apt to be over-luxuriant in its growth."

As, continues he, "the planters differ in their number of hills to be made on the same given quantity of land, so are they no less capricious as to the manner of placing them; some choosing to set them out with the most cautious regularity in rows of equal distances, whilst others prefer a triangular plant. The former method has this advantage, he thinks, over the other—that the intervals may, in the early part of the summer, be kept clean by means of the nidget and harrow, from which the latter is excluded by their irregular station; and thus the ground must be tilled by the hoe at a great increase of charge, as the same labour might be performed to as much advantage with one horse, a man, and a boy, who will do more work in a day than half a dozen labourers can with a hoe."

The author of Modern Agriculture observes, that March is the ordinary season for setting out the plants. But in the Synopsis of Husbandry it is stated, that, when a plantation is to be raised from cuttings, the proper time for setting them is in February or March; but if from bedded sets, it is best to plant them in the autumn. But at whatever period they are planted, great care should be taken that the same sorts be planted together, as by this means there are advantages derived in their after-culture. The method of performing this business, according to the former writer, is this:—"The land having been previously cleaned and prepared, dung is laid on the field in small heaps near the places where it is proposed to plant the hop slips or sets. These places are commonly marked off, by placing a number of stakes at proper and regular distances: that done, small pits are formed, by taking out a spit or spade depth of earth; and the earth below being gently loosed, a certain quantity, about half a bushel, of dung is laid thereon; then the earth that was formerly taken out is again replaced, and so much added as to form a small hillock. On this hillock, five, six, or seven sets, procured from the roots or shoots of the old stock, are dibbled in. The plants are placed in a circular form towards the top of the hillock, and at the distance of five or six inches from each other. They are made to incline towards the centre of the hillock, where another plant is commonly placed. In regard to the plants, the most necessary thing to be attended to is, he says, that they have each two joints, or eyes; from the one, which is placed in the ground, springs the root; and from the other the stalk, provincially the bind."

But, according to the author of the New Farmer's Calendar, "the time for planting is commonly that of dressing and pruning the old vines, when cuttings may be had, which is in March or April; but when root-sets are used, as on the occasion of grubbing up an old plantation, October to the beginning of November. The land having been deep-ploughed and worked to a fine level tilth, a plantation may be set out as follows:—Strike furrows with the plough equally distant, eight feet asunder; when finished, repeat the same across in the opposite direction, which will divide the piece into eight-foot squares. The hills are to be made where the furrows cross each other, and the horse-hoe may be admitted between the rows both ways." And, according to the Suffolk husbandry, the plantations are, he says, formed into beds sixteen feet wide, by digging trenches about three feet wide, and two or three feet deep; the earth that comes out being spread upon the beds, and the whole dug and levelled. Upon this they, in March, form the holes six feet asunder every way, twelve inches diameter, and a spit deep, by which three rows are formed on each bed. Into each hole they put about half a peck of very rotten dung, or rich compost; scatter earth upon it, and plant sets in each, drawing earth enough to them afterwards to form something of a hillock."

When the sets are planted, they require no more labour or attention, according to Mr. Donaldson, except keeping the ground around them clean, and free of all sorts of weeds, till towards the end of May, when, the young shoots having made some progress, it is common to increase the size of the hill on which they were planted to a greater extent than it was when first formed, and which is done by adding some of the finest and richest earth from the interstices. In the end of June, or beginning of July, those farmers who are not so avaricious as to set poles among the young shoots, with a view of reaping a partial crop the first year, to the imminent danger of injuring the future produce of the plantation, generally twist the young buds into a bunch or knot; so that by thus discouraging their growth the roots are enabled to spread out more vigorously, and to acquire strength previous to the approach of the winter season.

But Mr. Bannister remarks, that the bedded sets will produce a slight crop the succeeding autumn after they are planted, and will require ordinary poles or sticks about four feet in length; but from the spring-sets there must not be expected any return until the second year after planting. For this reason it is customary to set beans between the alleys; two rows of which may, he thinks, be planted in each interval without any damage to the hops, whether bedded sets or cuttings. In the latter case, this method may be pursued the second year, at the end of which the bind from the cuttings will not be in a forwarder state than that from the bedded sets in the first autumn after planting. Others, however, think that neither beans, cabbages, or any other plants except onions, should be put in. As the ground destined for a plantation of hops is generally presumed to be in good heart, for otherwise little profit can be expected to arise from it, the beans will produce a return sufficient, he asserts, to pay the expense of planting and cleansing the ground; which is a matter so essential to the future

welfare of the crop, that it ought on no account to be neglected.

Where cuttings are made use of, they should be made from the most healthy and strong binds, each being cut to the length of five or six inches.

The young plantation should be cut and dressed soon after Michaelmas, and the hills capped with some well-fermented dung and mould, thoroughly incorporated together, that the shoots may arise strong and vigorous in the spring; but in old grounds he thinks it better to defer this operation till March, especially on good land, or on ground subject to blast, as the protracting the cutting season seems to be a probable means of avoiding this malady, the forward bind being much more likely to be destroyed in a blighting year than that which is later in making its shoot. Hence, says he, the necessity of employing careful labourers for this work, as countrymen in general are but too prone to undertake jobs which are likely to be profitable, how unacquainted soever they may be with the proper method of conducting them. In the present instance, a crop of hops may be ruined through the unskilfulness of the cutter; either by leaving too great a redundancy of bind, whence proceed canker, &c. or by cutting the stock so low as to weaken the hills, by which the stock is prevented from throwing out a sufficient number of shoots: and in either case it is a very easy matter for the labourer to elude the vigilance of his master; for when the hops are cut, and the hills lightly covered with mould, as is the usual practice, there will be no vestage left whereby to trace the negligence and villany of the workmen. The only method of guarding against such practice is, as has been observed, to employ a person who has been long conversant in the business, and who is constantly to be engaged in the subsequent offices of the hop-ground, who will, for his own credit's sake, act with caution and circumspection. To observe that the hills are thoroughly opened, by which means alone they can be properly dressed, and frequently to watch the motions of the cutter, are the master's concern, and may be necessary for him to attend to, let the workman be ever so careful or honest.

The expense of forming new plantations must be various, according to circumstances and the local value of labour. In most of the hop districts it is stated to be from 75*l.* to 100*l.* including every thing necessary.

The young plantation is, Mr. Donaldson says, treated the second year in every respect similar to those of older standing; and that, with proper management, and when the soil is properly adapted to the growth of hops, a plantation will continue in full bearing for twenty or thirty years, all that is requisite being only to supply occasionally any deficiency of plants that may take place in some particular hills. Notwithstanding this, it is probably better in many cases to renew the plantations at much shorter periods, or to keep occasionally renewing some particular parts.

It is further observed, that, in the proper management of a hop-ground, great attention is required in order to render it productive. Whether it be kept clean by ploughing, or by the spade and the hand-hoe, the soil should be turned over at least two or three times in ordinary seasons, and oftener if any number of weeds appear. The plants also require great attention and considerable labour. On the return of good weather in the spring, the hills are spread out, in order to give opportunity to prune and dress the stocks. The earth being then cleared away from the principal roots by an iron instrument called a picker, the remains of the former years' binds are cut off, together with the shoots which were not allowed to attach themselves to the poles the former season, and also any young suckers that may have sprung up about the edges of the hills; so that nothing is allowed to remain that is likely to injure the principal roots, or impede their shooting out strong vigorous binds at the proper season. After the roots are properly cleaned and pruned, the hills are again formed, with an addition, if not every year, at least every second or third year, of a proper quantity of compost manure, that had been previously laid in small heaps on the hop-ground in the course of the winter, or in the early part of spring. Soon after the hills are formed, or towards the end of April, the new shoots begin to appear, at which time the operation of setting the poles commences. These are straight slender shoots of underwood, ash, oak, chesnut, or willow, from sixteen to twenty feet high. These poles are set two, but more frequently three, to a hill: they are so placed as to leave an opening towards the south, to admit the sun-beams. The manner of fixing them is by making deep holes or openings in the ground with an iron crow. Into these holes the root-ends are put, when the earth is rammed so hard about them, that they very seldom alter from the position in which they were placed, except on occasion of very violent gales of wind. Great care is necessary in placing the poles, and no less judgment and experience in determining what ought to be the proper height. When very long poles are set in a hop-ground where the stocks are too old or too young, or where the soil is of indifferent quality, the stocks are not only greatly exhausted, but the crop always turns out unproductive; as, till the binds reach the top, or rather till they overtop the poles, which depends on the strength of the stocks and the quality of the soil, the lateral branches on which the hops grow never begin to shoot out, or make any progress.

It is remarked by the author of Cursory Observations in Husbandry, that planters are much divided in their sentiments as to the number of poles to be set against each hill. Three poles are the general allowance, observing to place the stoutest pole to the northern aspect of the hill; though it is no uncommon practice to set four poles, and in strong land five or six, to a hill. In behalf of this latter mode it is urged, that, where the land usually produces a great redundancy of bind, it is prudent to set a number of poles answerable to the luxuriancy of the shoots. But, if a free circulation of the air be a matter of that importance to the well-being of a crop of hops, as

is generally imagined (and this is a doctrine which he believes cannot be controverted), the incumbrance of the hills, with an additional number of poles, cannot fail to be of infinite dis-service to the future growth of the hops; and he believes it will be readily acknowledged, that the quantity of hops on the same given number of hills will be more considerable, where three poles only are set up, than when the hills are crowded with a larger number; whether we consider the mischief likely to accrue from the stagnated air, or from the redundancy of the bind, by which the hops are prevented from arriving to their proper size or growth.

It is added, that the chief art in poling a hop-ground is, first, to pitch the hole to a proper depth, about twenty inches; next to set down the pole with some exertion of strength, so that the same being well sharpened may fix itself firm at the bottom; thirdly, that the tops of the poles may stand in such a direction as to lean outwards from the hill, to prevent, as much as possible, the housing of the bind; and lastly, to tread the earth close to the pole with the foot. For want of regard to these particulars in the labourer, a moderate blast of wind will loosen the poles, so as not only to occasion a double expense, but the hazard of injuring the future crop is very great, by tearing asunder the bind, which, from its great luxuriancy, will become twisted together, or, as it is termed, *housed* at the extreme parts of the poles.

And it is stated, that on the forwardest grounds the bind usually makes its appearance towards the middle of April, if the weather is kindly, and the hops were cut at the beginning of March; but if, from the unkindly state of the weather in the early part of the spring, or by the choice of the farmer, as being desirous to prevent a too forward exertion of the shoots, or from whatever other cause, the dressing of the hops has been protracted till the latter end of March, the appearance of the bind will be later in proportion, and in such case may probably not begin to show itself till the middle of May. In general it will, says he, be found most prudent to wait till the appearance of the bind before the business of poling is entered on; as, till the shoots become visible, the poles cannot be set down with the necessary exactness, except in very backward seasons, where the vegetation of the bind has been protracted till the middle or latter end of May, when it is necessary that the hops should be poled before that time, lest, from the growing weather which is then to be expected, the bind may be liable to shoot away too luxuriantly for the workman to keep pace with them.

"There is no period of its growth, says he, in which the hop is not subject to some malady or other. In its earliest state, the *flea* (being the same insect which frequently makes so great havock among the turnips) often devours the young shoots as fast as they appear above ground. It makes the most rapid progress in seasons wherein the nights are cold and frosty, and the days hot and dry; so that, in such a time, he has known large gardens fall a sacrifice to its destructive ravages: and though this insect is by no means so inimical to the crops as the *long-winged fly*, which attacks them in the more advanced state of their growth, since, when the bind is eaten off by the flea, a second shoot generally comes forth—yet, as every circumstance which tends to weaken the bind will eventually affect its future welfare, every precaution which may counteract this mischief ought to be taken by the planter. In the course of his observations on this vegetable, he has remarked that the flea is most apt to attack those grounds which have been dunged in the same year. For this reason, the following particulars relative to the article of manure have occurred to him as necessary to be attended to by those who would wish to avoid this malady:—first, that the dung be intimately mixed and incorporated with a due quantity of mould; and secondly, to observe the greatest caution in the time and manner of laying it on the ground. Raw dung, in whatever way applied, cannot fail to be of great detriment to the hops, by encouraging the generation of the flea; and to cap the hills with dung in the beginning of winter, as is practised by many people, is, he thinks, a very injudicious mode, as tending to the propagation of this insect; and, being taken off again at the cutting season, can, in his humble opinion, convey but a small portion of fertility to the stock. Others cap the hills with raw dung immediately after the hops are cut; but this practice is still more injudicious than any of the preceding, not only as it induces a plentiful brood of fleas to prey on the young shoots at their first appearance, but for another reason, which, having himself experienced its ill effects, he can speak to with the greater confidence. On the ground wherein he hazarded this experiment, the bind was obstructed in shooting out of the hills by the weight of the dung which had been pressed close to the surface by the rains which succeeded after the application of it. He was therefore under the necessity of removing the manure; and then the heat of the dung had so burned the young shoots, that had it not been for a succession of latter bind the poles would have remained naked the whole summer. Others there are who cover the whole surface of the ground with long dung; but this (though not likely to be attended with such ill consequences as the former method) will most probably encourage the flea; and therefore is far from being a commendable practice. The only method of dressing a hop-ground to advantage is, he says, to make choice of some well-fermented compost; and, if this can be had in sufficient plenty, to cover the whole ground over; otherwise to cap the hills immediately after the hops are cut. As hops are never perceived to grow away very fast till the nights become warm, in which case he has known the bind to shoot five inches in length within the course of twelve hours, it is during the vernal cold in the month of April and beginning of May that the flea commits its ravages; for, when a favourable change in the weather takes place, the bind soon grows out of the way of this enemy, and becomes fit for the tyers."

Mr. Donaldson remarks, that, after the poles are

fixed, a great number of the young shoots naturally twine round them: but people are also employed to go through the plantation, for the purpose of guiding any shoots that are taking a wrong direction, and of sorting them so that only two or three (and these the strongest and most healthy) are permitted to attach themselves to each pole. All the superfluous binds are cut off, so as to prevent their spreading over the grounds, or impeding the growth of those that are allowed to stand for a crop.

The last operation necessary to be attended to previous to the commencement of what may be called the *hop-harvest*, besides that of occasionally cleaning the ground of weeds, is, the same writer says, to tie the binds to the poles. This requires the labour of a number of persons: women are generally employed, who tie them in several different places with withered rushes, but so loosely as not to prevent the binds from advancing in their progress towards the top of the poles. When the binds have got to such a height as to be beyond reaching with the hand, proper persons go round, and, using standing ladders, tie all the binds that appear inclined to stray from the poles.

Various, says Mr. Bannister, are the seasons for this work in different grounds; for whilst in some gardens, either from the fertility of the soil, the warmth of the situation, or other circumstances, the bind will have advanced to that forwardness as to be in a condition to be tied by the beginning of May, other grounds, which are of a more poor and sterile nature, will not be fit for that operation till the first or second week in June. As this is a business on which the future welfare of the crop in a great measure depends, it is a matter of the last importance, he observes, to have it properly conducted; whereas the whole process of this work is often consigned to the management of ignorant women, by which the crop is too frequently spoiled. The forwardest bind should, he thinks, always be extirpated, as it is well known that the branches arising from these early shoots will produce little, if any fruit. The second shoots, where the hills are not overloaded with plants, and where the ground is not of a nature to send forth a very luxuriant bind, may with safety be tied up. But where the land is apt to push forward a great redundancy of shoots, where the bind is always strong and vigorous, and where the failure in the crop chiefly arises from this cause, the greatest prudence is necessary, at the season for tying, to make choice of a proper bind; especially in years which may be supposed to be attended with a blast; such as those wherein an easterly wind has prevailed throughout the month of March, whence one may fairly conclude that the same weather will happen during the course on the month of May, which never fails to bring the long-winged fly. In such a season it would, in his opinion, be well worth while to eradicate all the bind which first appears, and trust to a latter shoot, so as to protract the tying till the last week in May. This hint was taken from the observations made on the poor and thin lands in such blasting years where the bind is naturally backward, and seldom becomes fit for the tyers till towards the latter end of May, when that on the forward ground will have advanced nearly to the tops of the poles, and to an inattentive observer seems to promise fair for a crop; whereas, to those who have been conversant in these matters, the loss of the crop, though the the bind at that time be green and flourishing, may be easily foreseen; whilst on the poorer soils there is generally a saving crop even in years when the blast is most prevalent. These considerations, he says, have suggested the protracting the growth of the bind in the manner above-mentioned, which seems, he thinks, conformable to reason and experience.

The author of Modern Agriculture remarks, that hops are known to be ready for pulling when they acquire a strong scent, and the seeds become firm and of a brown colour, which, in ordinary seasons, happens in the first or second week of September. And when the pulling season arrives, the utmost assiduity is requisite on the part of the planter, in order that the different operations may be carried on with regularity and dispatch; as the least neglect, in any department of the business, proves in a great degree ruinous to the most abundant crop, especially in precarious seasons. Gales of wind at that season, by breaking the lateral branches, and bruising the hops, prove nearly as injurious as a long continuance of rainy weather, which never fails to spoil the colour of the crop, and thereby render it less saleable.

And as a preparation for pulling the hops, frames of wood, in number proportioned to the size of the ground, and the pickers to be employed, are placed in that part of the field which, by having been most exposed to the influence of the sun, is soonest ready. These frames, which are called *bins* or *cribs*, are very simple in the construction, being only four pieces of boards nailed to four posts, or legs, and, when finished, are about seven or eight feet long, three feet broad, and about the same height. A man always attends the pickers, whose business it is to cut over the binds near the ground, and to lay the poles on the frames to be picked. Commonly two, but seldom more than three, poles are laid on at a time. Six, seven, or eight pickers, women, girls, and boys, are employed at the same frame, three or four being ranged on each side. These, with the man who sorts the poles, are called a set. The hops, after being carefully separated from the leaves and branches, or stalks, are dropped by the pickers into a large cloth, hung all round within-side the frame on tenter-hooks. When the cloth is full, the hops are emptied into a large sack, which is carried home, and the hops laid on a kiln to be dried. This is always done as soon as possible after they are picked, as they are apt to sustain considerable damage, both in colour and flavour, if allowed to remain long in sacks in the green state in which they are pulled. In very warm weather, and when they are pulled in a moist state, they will often heat in five or six hours: for this reason the kilns are kept constantly at work, both night and day, from the

commencement to the conclusion of the hop-picking season.

On this subject Mr. Bannister observes, that it is a matter of prudence, in the picking season, to set on a sufficient number of hands, that the *oasts* may never be unsupplied with hops; and if it is found that the hops rise faster than could have been expected, and that there are more gathered in a day than can be conveniently dried off, some of the worst pickers may be discharged; it being very prejudicial for the green hops to continue long in the pokes before they are put on the oast, as they will in a few hours begin to heat, and acquire an unsightly colour, which will not be taken off in the drying, especially if the season be very moist; though, in a wet hopping, it is no easy matter to prevent the kilns from being overrun, supposing that there were pickers enough to supply them if the weather had been dry, because in a wet cold time the hops require to lie a considerable while longer on the kiln, in order that the superabundant moisture may be dried up. It is therefore expedient in this case that each measuring be divided into a number of green pockets or pokes. The number of bushels in a poke ought never to exceed eleven; but when the hops are wet, or likely to continue together some time before they go on the kiln, the better way is to put only eight bushels in a poke.

Mr. Donaldson asserts, that diligent hop-pickers, when the crop is tolerably abundant, will pick from eight to ten bushels each in the day, which, when dry, will weigh about one hundred weight; and that it is common to let the picking of hop-grounds by the bushel. The price is extremely variable, depending no less on the goodness of the crop than on the abundance or scarcity of labourers. The greatest part of the hops cultivated in England are picked by people who make a practice of coming annually from the remote parts of Wales for that purpose.

And the author of the Synopsis of Husbandry observes, that the usual method by which the wages of the pickers are regulated in the county of Kent is at a stated price per bushel; and the hops are picked either into bins or baskets: the latter, however, are rarely used, except in the neighbourhood of Canterbury. One pole-puller, if he be expert at his business, will supply three bins, at each of which, according to the size made in this part of the country, are stationed four pickers: but these, in some places, are termed half-bins; so that, allowing the oast to dry off eighty bushels at each measuring, the hops to hang fair for the pickers, and these to attend diligently to their work, four bins, or sixteen hands, would be a proper number to employ: but because the hops often run uneven, and the weather is frequently very unsettled at the picking season, and some of the women will be idle, and earn only trifling wages, it will perhaps be more prudent to set on five bins, or twenty hands, to supply kilns of this size; and these, where the bind is very housy and luxuriant, will find sufficient employment for two men to draw the poles. But if the poles are of the second size, and the bind not housed at top, the pole-puller's employment will be very easy; and this is an office which the country people are commonly most anxious to secure. The wages to the pole-puller, when paid by the week, are, it is observed, from 18*d.* to 2*s.* per day, with small beer; which is a very good salary, as the hopping in a fruitful year seldom continues less than a month, and no deduction is made for loss of time in wet weather, which frequently disappoints the master of a kiln of hops. These wages have lately been much increased. In some places, particularly in the neighbourhood of Maidstone, it is the custom for the person who pulls to strip the bind from the poles and to stack them. This practice, though a very laudable one, cannot be followed on every ground; for where the bind is housy, so as to require much pains in disentangling it at the upper part of the poles, or if the poles be very short, so that the pickers are continually calling out for a fresh supply, it would be next to an impossibility for the pole-pullers to find time for stripping and stacking. There is another reason, likewise, which will ever render it difficult to bring this custom into general use, even though the poles were long, the bind not housy, and loaded like the Maidstone poles from top to bottom, which is, the not being habituated to this method.

And besides the pole-pullers and pickers, another person will, he says, be required in the hop-garden, whose business it will be to gather up the branches which may be lying about the alleys, and to carry the hops to the kiln. This office may be performed by a lad, who, from the nature of his employment, is called a *poke-boy*, and has a cart and horse to convey the hops to the kiln; or, where the oast lies contiguous to the hop-garden, the pokes may be carried thither on horseback, or any other easy method.

And further, the strict attendance required to be given to the hoppers, which are generally made up of women of the lowest classes, together with the anxiety occasioned by the continual fire which must, of necessity, be kept in the oast, where his whole property may be destroyed through the carelessness or perfidy of the drier, contribute to render this the most fatiguing part of the farmer's business: and for this reason, it is of the utmost consequence to fix on a person, for a drier, of skill, sobriety, and good morals, since a matter of such importance is to be intrusted to him. The usual wages to a drier are fifteen shillings per week, or ten shillings and his diet, with an allowance unlimited of strong beer and spirits; and this, considering the fatigue and continual nightly watchings required, cannot by any means be deemed an unreasonable salary. These wages are now much greater. The price for picking is from one penny to three-halfpence per bushel, with a dram of geneva every morning, and a feast at the end of the picking; and in many places other allowances.

The author of the Present State of Husbandry in Great Britain observes, that the form of the kilns used for drying hops is not materially different from

that of those used for drying malt. The hops are spread on a hair cloth, and from eight to ten, sometimes twelve, inches deep, according as the season is dry or wet; and depending also on the state of the hops in regard to ripeness. A thorough knowledge of the best method of drying hops can only be acquired by long practice. The general rules are to begin with a slow fire, and to increase it gradually, till, by the heat on the kiln, and the warmth of the hops, it is known to have arrived at a proper height. An even steady fire is then continued for eight or ten hours, according to the state or circumstances of the hops, by which time the ends of the hop-stalks become quite shrivelled and dry, which is the chief sign by which to ascertain that the hops are properly and sufficiently dried. They are then taken off the kiln, and laid in a large room or loft till they become quite cool; and they are now in condition to be put into bags, which is the last operation the planter has to perform previous to sending his crop to be sold.

It is stated, in the Synopsis of Husbandry, that when hops are dried on a *cockle-oast*, sea-coal is the usual fuel, of which a chaldron is generally esteemed the proper allowance to a load of hops. On the hair kilns, charcoal is commonly used for this purpose. Fifty sacks of charcoal are termed a load, which usually sells for about fifty shillings. The price for burning is three shillings per load, or twelve shillings for each cord of wood.

The process of drying having been completed, the hops are to be taken off the kiln, and shovelled into an adjoining chamber called the *stowage-room*; and in this place they are continually to be laid as they are taken off the kiln, till it may be thought convenient to put them into bags, which is rarely done till they have lain some time in the heap; for the hops, when first taken off the kiln, being very dry, would (if put into bags at that time) break to pieces, and not draw so good a sample as when they have lain some time in the heap; whereby they acquire a considerable portion of toughness, and an increase of weight.

Mr. Donaldson states, that in the floor of the room, where the hops are laid to cool, there is a round hole or trap, equal in size to the mouth of a hop-bag. After tying a handful of hops in each of the lower corners of a large bag, which serve afterwards for handles, the mouth of the bag is fixed securely to a strong hoop, which is made to rest on the edges of the hole or trap; and the bag itself being then dropped through the trap, the packer goes into it, when a person, who attends for the purpose, puts in the hops in small quantities, in order to give the packer an opportunity of packing and trampling them as hard as possible. When the bag is filled, and the hops trampled in so hard as that it will hold no more, it is drawn up, unloosed from the hoop, and the end sewed up, other two handles having been previously formed in the corners in the manner mentioned above.

Mr. Bannister asserts, that sixty bushels of fresh gathered hops, if fully ripe, and not injured by the fly or other accident, will, when dried and bagged, produce a hundred weight. Where the hops are much eaten by the flea, a disaster which often befalls them, the sample is not only reduced in value, but the weight diminished; so that, when this misfortune occurs, the planter experiences a two-fold loss.

As the chief virtue of the hop resides in the yellow powder contained in it, which is termed the *condition*, and is of an unctuous and clammy nature, the more or less clammy the sample appears to be, the value will be increased or diminished in the opinion of the buyer. To this may be added the colour, which it is of very material consequence for the planter to preserve as bright as possible, since the purchaser will always insist much on this article; though, perhaps, the brightest coloured hops are not always the strongest flavoured. This consideration induces the grower to put the brightest and finest coloured hops into *pockets* or fine bagging, and the brown into coarse or heavy bagging. The former are chiefly used for brewing fine ales, and the latter by the porter-brewers. But it is to be observed, that where hops are intended to be kept for any length of time, it is most proper to put them into coarse cloth. The proper length of a bag is two ells and a quarter, and of a pocket nearly the same, being one ell in width. The former, if the hops are good in quality, well cured, and tight trodden, will weigh about two hundred and a half; and the latter, if of the Canterbury pocketing, about one hundred and a half. If the weight either exceeds or falls much short of this medium, it induces a surmise, he says, that the hops are either in themselves of an inferior quality, or have been injudiciously manufactured in some respect or other.

The hops being thus picked, dried, and put into bags, the next operation which comes in course to be performed is the stripping and stacking of the poles, unless this task has fallen to the share of the pole-puller or bin-man, as has been observed to be the custom in many places. It is of some consequence that this business be executed as soon as possible after the crop is removed; not only that the poles may be much safer from thieves when set up in stacks, but that in such form they may take far less damage by the weather than when dispersed about the ground with the bind on them. The usual price for stripping and stacking is five shillings per acre. At this time, such poles as may be deemed unfit for further service should be flung by, that the planter may have an early knowledge of the number of new poles which will be wanting; and thus the business of bringing on the poles may be completed in the winter time, when the horses are not required about other labour: and these new poles may be drawn from the wood on the ground, and adjusted to the separate stacks, as the state of the different parts of the ground may require, and the whole business be completed before the poling season; whereas, when this method of flinging out the old poles is neglected at the stacking, the planter, being ignorant of the number of new poles that will be required for the ensuing year, often finds, at the poling season, that he has not laid in a sufficient stock. "This," says Mr. Bannister,

"causes a great deal of trouble and vexation to him, in being obliged to waste his time in a search which not unfrequently proves abortive; for as the woodmen endeavour to fell their hop-poles early in the winter, it will be odds that there are any left on their hands, and the planter must then content himself with setting up those poles which he would otherwise have thrown by; and which, long before the hops are ripe, will sink under the weight of the crop, to the no small injury of the grower; or if he should by chance meet with new poles at this advanced season, these will in all probability be of beech wood, which is of little worth, and in such a situation where the miry condition of the roads will render it very difficult for the waggons to get along; as those woods which consist of ash and willow, and such as are in the vicinity of good roads, are always first cleared." And that, besides, "the loss of time, in being under an obligation of taking the teams off from the other necessary works, is often very great; and the poles that are now brought on the ground cannot be drawn to those parts where they are most wanted, as might have been practised in the winter, but must be tossed over the hedge, and afterwards be removed by labourers at thrice the expense, or else be set up to those hills near the hedges, where there is generally the weakest bind. All these reasons combine very forcibly, he thinks, to recommend the practice of flinging by all the weakly poles at the time of stacking. Some of these may be strong enough, and of a sufficient length for a young ground, and if the planter is possessed of any, such may be immediately conveyed to it; and if not, they may be set up in stacks, to be in readiness for a chapman, as there is little doubt but one may be found for them in the course of the winter; and such as are too weakly or too short for that purpose may be carried together for fire-wood, or to be converted into charcoal. At the time when the stacks are set up, it will also, he says, be convenient to sharpen those old poles which may require it, and the new poles being brought on the ground in winter, as before directed, and sharpened and set up against the stacks where wanting, there will, at the season for poling, be nothing to impede the progress of that business."

And he advises, that "the bind should in some way be disposed of as soon as the poles are stripped. Many people burn it on the ground. Others suffer it to be carried off by their workmen for firing; and there are some, who tie it up into small bundles, which they bring home and form a stack, to answer the purpose of bavins in heating their ovens or coppers. The expense of binding is about 6*d.* per hundred. But it remains a doubt with him whether this fuel pays the expense of binding and cartage, where there is plenty of wood on the farm, or where the hop-garden lies at a distance from the dwelling-house. Yet, in districts where firing is scarce, and the ground contiguous to the house, this method of making the bind into small bundles may answer very well, as they are perfectly adapted to the purposes above mentioned. But should it not be convenient to pursue this plan, it is far better to set fire to the bind in the ground, than to suffer it to lie in heaps during the winter;" not only from its being a slovenly practice, and affording obstruction to the diggers, but as affording an excuse for persons entering the garden, on pretence of fetching away the bind, while their real errand may probably be to fetch the poles.

The next business is that of the winter digging of the plantation; and "the earlier this work is performed, the greater chance will the ground have of being meliorated by the winter's frosts; but as the weather in the months of October and November is frequently wet and unsettled, it seems better to defer the digging till towards Christmas, and then to fix upon as dry a time as possible, and by setting on a sufficient number of labourers to get the whole finished with the utmost expedition and dispatch. The price for digging is from eighteen-pence to two shillings per hundred hills; and as in this business the labourer has it in his power to show his dexterity by deceiving his employer, it should seem advisable to engage only with those whose integrity may be depended on, and who are to be retained either in the subsequent operations of the hop-ground, or on some other parts of the farm during the course of the year: these men will, for their own credit's sake, act with greater caution and more circumspection than they who travel the country to pick up casual jobs, who, as they may never again work on that spot, are totally indifferent as to the character they may leave behind them; their chief endeavours being to elude the vigilance of the master.

"The work is usually performed with a three-tined fork, the tines or prongs being an inch and a half in breadth, and this instrument by the Kentish planters is termed a *spud.*" It is of much consequence that this business should "be properly executed in the winter, since on this in a great measure depends the destruction of those weeds whose roots cannot so effectually be extirpated by the hoe." It is likewise the practice with "those who are curious in the management of their hop-grounds, and wish to produce a bright and elegant sample at picking time, cautiously to eradicate the red bind; and for this reason such hills, which may have produced this bind, are grubbed up in the autumn, and replanted with sets of the same kind of hop with the general plantation. To answer this intention, it will be convenient to set apart yearly a small portion of ground for raising bedded sets, which will be in readiness not only for supplying the hills that may have been grubbed up on the above account, but for remedying any defects that may have arisen from lost hills, not a few of which will require to be fresh planted every season. The cut-sets for this purpose are to be planted in rows in a corner of the hop-garden, or on any waste spot, and will be ready to plant out for bedded sets the next year."

Although the use of manure may not be necessary in particular instances in the second year of the plantation, especially where the soil is of the rich fertile kind, in the succeeding ones it should constantly be applied before the work of winter-digging is begun,

in the quantity of about twelve full cart-loads to the acre, after being well blended and intermixed with twelve or fifteen loads of good fresh vegetable mould, by repeated turning during several months. It is then usually put upon the land in small heaps, by means of small one-horse carts with three wheels; when, in the operation of digging the plantation, it is carefully mixed with the surrounding earth of the hills at the distance of about a foot from them.

The prices usually paid in the county of Kent for the different operations in the hop-grounds, before the late rise, are stated to be these:

	£.	s.	d.
Stripping and stacking the poles, per acre	0	5	0
Winter-digging	0	18	0
Cutting	0	6	0
Poling	0	12	0
Sharpening old poles, per stack 2*d.*	0	1	0
Sharpening new poles, per hundred 3*d.* about	0	2	0
Tying	0	10	0
Summer digging, if practised	0	18	0
Hoeing	0	5	0
Hilling	0	3	0
Shaving, per hundred, 1*s.* 2*d.* but ashen poles require it not, so this operation may be set at	0	9	4
Picking, according to the crop from 1*d.* to 2*d.* per bushel; bagging, 8*d.* for coarse, and 6*d.* fine	4	9	4
Take off summer digging	0	18	0
	3	11	4
Add nidgeting	1	0	0
	£.4	11	4

And he states "the following as the usual calculation of the total annual expense on an acre of hop-ground, allowing the growth to be 10 cwt. per acre, and supposing the several manual operations are performed at a stipulated price, which is often undertaken by a neighbouring workman well known to the planter, and in whom he can safely confide; and which, as it relieves the farmer from a great deal of trouble, is by many people considered as the most eligible method."

	£.	s.	d.
"To the undertaker for looking after the hop-ground, and he to pay his under workmen for digging, poling, and every other operation in the ground	£3	10	0
Picking, drying, and duty	13	0	0
Rent	1	0	0
Poles	6	0	0
Dunging	2	10	0
Tythe	0	10	0
Bagging to put the hops in	2	0	0
Carried over	28	10	0

	£.	s.	d.
Brought forward	28	10	0
Deduct summer digging	0	18	0
	27	12	0
Add nidgeting	1	0	0
	28	12	0
But if the farmer pays the several workmen himself, the expenses, according to the account first stated, will amount to	4	11	4
Poles	6	0	0
Picking, drying, and duty	13	0	0
Rent	1	0	0
Dunging	2	10	0
Tythe	0	10	0
Bagging to put the hops in	2	0	0
	29	11	4
Balance in favour of the first plan	£0	19	4

When the old stocks begin to decline, as about every tenth year, but much longer in some instances, they should be taken up, and a fresh portion of ground be planted; but a better method is that of breaking up and planting a portion of new ground every two years, letting an equal quantity of the old be destroyed, as in this way up a regular succession of good plantation will be kept at a trifling charge.

The expenses of forming new hop-plantations is in general very great, being estimated, in many districts, at from not less than seventy to a hundred pounds the acre.

The produce of crops of this kind are liable to very considerable variation, according to soil and season, from two or three to so much as twenty hundred weight; but from nine to ten, on middling soils, in tolerable seasons, are considered as average crops, and twelve or fourteen good ones.

The author of the Hints to Gentlemen Farmers states the expenses of cultivation, and the profits of the produce, as below:

EXPENSES PER ACRE.

	£.	s.	d.
Medium price of an acre of land, suitable for hops	1	10	0
Digging the ground	0	13	0
Dressing and pruning	0	8	0
Poling	0	15	0
Three hoeings	0	9	0
One moulding	0	3	6
Tying the binds to the poles	0	12	0
Stripping the binds off the poles	0	3	0
Stacking the poles	0	4	0
Sharpening the poles	0	10	10
Manuring	2	0	0
Carried over	7	8	4

	£.	s.	d.
Brought over	7	8	4
Picking, drying, and duty, at 1*l*.10*s*. per hundred, the crop being estimated at 12 cwt. the acre - -	18	0	0
Bagging, and occasional expense of bags, about - - - - -	0	16	0
Ash poles, estimated at 30,250 to an acre, and supposed to last eight years, medium price 18*s*. per 100 at the stub, the eighth part of which is nearly	3	13	0
Carriage of do. estimated at -	1	5	0
	31	2	4
PRODUCE.			
Supposing 1200 per acre, and that the medium price is 4*l*. the hundred, the amount will be - -	48	0	0
And the expense deducted out of the produce will leave a medium profit of	£16	17	8

In respect to the state of the season most favourable to crops of this nature in the different stages of their growth, it is that which is warm without too much rain, and where south or south-westerly winds prevail; as the hop is a plant which never succeeds well in such seasons as are wet, or when easterly or northerly winds continue for any great length of time during the summer months. Hot gleams of sun-shine after rain, or after foggy mornings, in the later summer months, are found to prove highly detrimental to these crops. High winds towards the approach of the picking season likewise produce considerable mischief, by bruising and otherwise injuring the hops. When unfavourable weather takes place, about the period in which the plants are in blossom, it is seldom that the produce is good or abundant, as many of the *burs* generally suffer in such a manner as to prevent their forming perfect hops. And it is found, that in common very forward binds suffer more from all the different accidents to which hop-crops are exposed, than those that are later and of a less vigorous growth; on which account, it may sometimes be advisable to remove all the very forward binds from the plantations.

As it is well known, that if hops are picked before they are ripe, they are not only difficult to manage on the kiln; but, like herbage that has been cut too young, shrink in drying, and yield short weight in the scale; besides being injured by the bleeding of the vines. And that, on the contrary, if they are suffered to hang too long on the vines, they lose the brightness of their colour, and the finer part of their flavour; it may be necessary to give the following rules of judging as stated by Mr. Marshall:

"The criteria, says he, of a want of ripeness may be set down as follows: The scales remaining green, flexible, and tough; holding fast to the receptacle or *strig* of the hop; and standing out from it, wide and open. The seeds likewise remaining firmly in their places; and, on being crushed, discovering a milky juice, similar to that of grain, in a certain state of growth.

"The marks of sufficient ripeness are these: The colour of the hop having changed to a pale yellowish green; a criterion, however, which is least to be depended upon. The scales having closed upon each other, and having acquired a degree of firmness of texture in themselves; but, on being disturbed, easily breaking off from their receptacle. The seeds, in like manner, loosening freely from the scales, and if the hop be shook before the scales are disturbed, being heard to rattle within them. And, on removing the coat of the seed, a firm polished grain or kernel is discovered. If a ripe hop be crushed between the fingers, it affords a strong, but agreeable flavour, and a degree of clamminess proportioned to the season, the ground, and the variety of the hop. In other words, the scales lose their openness and flaccidity in ripeness; the globular or oval shape of the hop changing into that of an imperfect long cube, which possesses a degree of firmness and elasticity; the scales, of which it is composed, springing back, after being pressed between the fingers. If a ripe hop be held firmly by the stalk, and rubbed, with a circular motion, in the palm of the hand, the scales readily break off, and the seeds are found loose among them. Or if, on being held in a similar manner, it be struck upward, or against the grain, with the finger, and the scales and seeds fly off, leaving the receptacle naked, it is a sign of sufficient ripeness. On the contrary, if, under either of these tests, the scales and seeds adhere obstinately to the strig or receptacle, it is a proof that they have not received the whole of the nutriment which nature has provided for them."

There is scarcely any sort of plant cultivated as a field-crop that is more liable to become diseased than that of the hop. It is apt in the very early stage of its growth to be devoured, as it rises above the surface of the ground, by the ravages of an insect of the *flea* kind. At a more advanced stage, it is subject to the still more injurious effects of the *green* or *long-winged fly*, *red spider*, and *otter moth*: the former, by the depositing of their ova, afford the means of producing lice in great abundance; by which the plants are often very greatly, if not wholly, destroyed, and the *larvæ* of the latter prey upon the roots, and thus render the plants weak and subject to disease. And the *honey-dew* is another disease to which the hop is exposed about the same time, and by which it is often much injured. But the *mould* or *fen* occurs in general at a somewhat later period, being equally injurious. Hop-crops are also exposed to other injuries, as the *blight*, and *fire-blast*, but which take place at different times, though mostly towards the latter periods of the growth of the plants.

With regard to the flea, which is said to be an insect of the same kind as that which is so prejudicial to the young turnip, it is observed to make the greatest havock in seasons where the nights are cold and frosty, and the days hot and inclined to be dry; eating off the sweet tender tops of the young plants; and which, though not wholly destroyed, shoot forth

afterwards in a far less vigorous manner; of course become more exposed to diseases. It has been found to commit its depredations most frequently on the plants in grounds that have been dunged the same year; on which account it has been suggested that the manure employed for the purpose of covering the hills should be previously well mixed and incorporated as directed above; and that it should be applied either over the whole of the land, or only the hills, as soon as possible after the plants have been cut over; but the former practice is probably the best. It makes its greatest depredations in the more early cold spring months, as the latter end of April and beginning of the succeeding month, disappearing as the season becomes more mild and warm.

In these cases, the principal remedy is that of having the land in a sufficient state of fertility, to enable the young plants to shoot up with such vigour and rapidity as to become quickly incapable of being fed upon and devoured by the insect. And the frequent stirring of the mould about the roots of the plants by the hoe may be of utility in the same view.

With respect to the green or long-winged fly, it mostly makes its appearance about the latter end of May, and in the two succeeding months; being supposed to be much produced by the prevalence of north-easterly winds about that period. It is highly destructive to the young leaves of the plants. They are said, under such a state of the wind, to scarcely ever fail covering the leaves; and, by dropping their ova, producing an abundance of lice, by which the crops are often much injured; as when they have once obtained complete possession of the plants, they seldom or ever leave them before they are wholly destroyed. The forwardest and most luxuriant hop-binds are in general the most disposed to be attacked by insects of this sort. Their removal chiefly depends upon a change taking place in the wind more to the south, and the setting-in of more mild, warm, and temperate weather.

It has been found that the otter moth, by producing its *larvæ* upon the roots of the plants, renders them liable to be attacked, and the healthy growth of the hops to be thereby greatly impaired, the crops being of course much injured in their produce. Stirring the earth well about the roots of the plants may probably sometimes be serviceable in cases of this kind.

There is another disease, which is the honey-dew, which mostly occur after the crops have been attacked by some of these kinds of insects, and when the weather is close, moist, and foggy. In these cases, a sweet clammy substance is produced upon the leaves of the plants, which has the taste of honey, and they have at first a shining appearance, but afterwards soon become black.

It is a disease that mostly happens in the more forward crops; and the chief dependence of the planter for its removal, according to Mr. Bannister, is that of heavy thunder showers taking place; as by this means, when the destruction of the hops has not proceeded too far, they are often much restored, the insects that devour the leaves and binds being greatly destroyed, the growth of fresh shoots promoted, and a favourable bloom brought on the plants.

It is well known that the fen, mould, or mildew, is a disease to which the hop-crop is exposed at a later period of its growth, and which chiefly attacks the part where the hop is attached to the stem. It is said that its production is greatly promoted by moist damp weather, and a low situation; those hop-crops, that grow on low, close, rich grounds, being the most liable to be attacked by it. And it is found to soon spread itself over the whole crop, after it has once seized upon any part of it; but the nature of this vegetable disease has not been yet sufficiently investigated. It has lately, however, been suggested by Dr. Darwin, to be a plant of the fungus kind, that is capable of growing without light or change of air, attaching itself to the plants already in a morbid condition, and by its roots penetrating their vessels. And on this supposition, the best remedy is believed to be that of thinning the plants, or wholly removing those immediately about it, in order to afford a more free circulation of air, and admit the light more extensively; by which the vigour of the hop-plants may be restored, and the disease be of course removed. In this view, it is probable, by planting the hills more thinly, and making them at greater distances from each other, it might in a great measure be prevented from taking place. See *Mildew*.

Diseases termed blights are frequently met with in hop-crops, at different periods of the growth of the plants, but mostly in the more early stages of their rising from the hills, while the nights are cold and frosty in the spring months, and the days have much sun and heat; by which the living powers of the plants are greatly exhausted in the day-time by the stimulus of heat, and of course much injured, or wholly destroyed in the nights, from being exposed to a freezing air, which is incapable of exciting the actions which are necessary for the preservation of vegetable life. As the presence of this disease is supposed to be greatly connected with the prevalence of winds from the northern or easterly quarters, there is often a flea produced of a similar kind to that which attacks the binds in their early growth, and which is highly prejudicial by preying upon the *condition* of the hop, and thereby diminishing their weight, and changing them to a brown colour; which is very prejudicial in their sale at the market. See *Blight*.

But the fire-blast is a disease that hop-crops are exposed to, in the later periods of their growth, and generally supposed to proceed from the particular state of the air or weather. But it has been conjectured as more probable, that it may be the effect of lightning, as it takes place for the most part at those seasons when it is the most prevalent, and in a very sudden manner. And besides, the most forward and most luxuriant binds are the most subject to be affected. It has been suggested, that in exposures that are particularly liable to have the crops thus injured, it may be advisable to keep back the growth of the plants as much as possible, by extirpating all the most forward shoots, as well as by employing a less proportion of the earthy compost in their cul-

ture. And that, by having the plants to stand at greater distances than usual from each other, advantages may probably be derived.

In respect to the duty, it is best for the planter to have the acts before him. But "every grower of hops is legally obliged to give notice, on or before the first day of September, of the number of acres he has in cultivation; the situation and number of his oasts; the place or places of bagging, which, with the store-rooms, or warehouses, in which the packages are intended to be lodged, are entered. No hops can be removed from the rooms thus entered before they have been weighed and marked by a revenue officer; who marks, or ought to mark, not only the weight, but the name and resideuce of the grower, upon each package.

"The original duty was a penny on every pound weight; but the percentages, which have since been laid on, had raised it, in 1790, to about twenty-four shillings a bag, and thirteen shillings and sixpence the pocket; that is, near ten pounds a ton. And this duty is usually paid to the collector of the excise for that district; the growers being allowed six months credit."

Though it is often the practice of hop-planters to introduce other plants, such as turnips and cabbages, among hops, this should never be attempted, as it does much injury by preventing the necessary culture, and effectual stirring of the earth.

The profits of hop-culture must obviously be materially different under different states and circumstances of the soil. Where the lands are of the proper sort for them, and there are hop-poles on the farm, and the farmer has a sufficient capital, it is probably a sort of husbandry that may be had recourse to with advantage; but under the contrary circumstances, they will seldom answer. In growing them in connection with a farm, regard should be had to the extent that can be manured without detriment to the other tillage lands.

On the whole, hops are an expensive and precarious crop, the culture of which should be well considered before it is entered upon.

Hop-*Bag*, the bag of sacking, into which the hops are stowed for sale. The cloth for this use is of two kinds; those hops, which are of a bright colour and fine quality, are put into bagging of a better kind, under the title of *pockets;* but the dark coloured sorts, into a coarse heavy sort, which are termed *bags;* the former being employed for ales and the finer sorts of malt-liquors, and the latter chiefly for porter. The coarse bagging is said to be the best, where hops are to be kept.

The length of cloth for a bag is about two ells and a quarter, and for a pocket nearly the same, being each an ell in width. The first, where the hops are of a good quality, well cured, and tightly trodden into the bag, weighs about $2\frac{1}{2}$ cwt. And the latter, when of Canterbury pocketing, about $1\frac{1}{2}$ cwt.

When there are variations to any extent from these quantities, the quality or preparation may be suspected.

Hop-*Basket*, a sort of large flat basket, used for the purpose of conveying the hops in during the picking season.

Hop-*Bin*, the crib, or bin, into which the hops are picked from the bind. It is usually constructed in a temporary manner, by nailing four or more pieces of boards on as many upright posts set into the ground as a sort of frame. Thus finished, they should be seven or eight feet in length, three feet in breadth, and the same in height, the side pieces projecting at the ends for handles. "At either end, a support rises two feet above the top of the frame; and, on the tops of these, rests a straight pole, the length of the frame, or something longer: the general construction and appearance resembling those of a small market-booth, without its covering; except that, instead of a table, to receive wares, a canvas bag, suited to the size of the frame, is hung within it, so as nearly to reach the ground; to receive the hops, as they are picked. Those of eight feet long are called *bins;* those of four feet, *half-bins.*" The bins should be in proportion to the extent of the pickers.

Hop-*Dog*, a kind of lever made of a long piece of strong round wood, with a sort of fixed fulcrum or support, to the lower end of which is fastened a strong piece of iron set with teeth, which grasps the lower end of the hop-pole firmly, and, by the action of the lever, wrenches up the pole with great facility.

Hop-*Harrow*, a sort of harrow, which is used by some hop-planters after the nidget, for bringing the ground into a still finer state of mould: it is constructed nearly in the form of the nidget, but with a small wheel in the front, in order to go round at the ends of the plantations more readily. A pair of handles are fixed on behind, by which it is guided in the alleys, and kept from bruising the binds, by the person who holds them. And it costs, when properly made, from about thirty to forty shillings. It is stated in the Report of the County of Middlesex, that a tool of this sort is in use by Mr. Maynard for cleaning hop-grounds, which resembles the snow-plough in shape; it is an equilateral triangle, the sides of which are four feet long, and the front ones shod with old scythes; the whole being strongly framed, in order that it may be loaded when employed. He says that, "by drawing it once in a place, in the intervals between the rows, it renders them perfectly clean, and as smooth as the well rolled walk of a pleasure-ground, and earths up the rows by the same operation, which, about ten days afterwards, are easily made into hills with spades."

Hop-*Hovel*, a place of shelter for performing the business of picking hops in, where the plantation is at a distance from a house.

Hop-*Nidget*, a tool formed in a triangular manner, and of different sizes, according to the distances of the alleys in which it is to be made use of, with cross-bars or beams, in which are fixed a number of hoes, in proportion to the breadth of the intervals between the rows of hops; so that its hinder parts, which is the widest, may pass without doing any mischief to

the binds on each side. The hindermost has fixed to it a pair of handles, by which the implement is directed to its work. It is drawn by one horse, managed by a boy; and two acres may in this way be cleansed in a day. Care should be taken, when using it, that, in finishing, the alleys be all crossed in the same direction, in order that every part of the surface, except the spaces which the hills occupy, may be cut over. The hills are to be afterwards rendered clean by means of hand-hoeing. It will be necessary to continue the use of this implement, as occasion may require, until the branches of the hops are put forth in such a manner as to prevent the horse from going along the alleys. By this means, hop-grounds may be kept clean and in order at a much less expense than by hand-hoeing, or even digging them in the summer. But a principal circumstance always to be attended to in the management of the nidget is, that of guarding against its damaging the binds, by coming too near the poles in the operation.

Hop-*Peeler*, a tool which is made use of for forming holes for the hop-poles: it is a sort of iron crow with a wooden handle across at the top, and made thick and tapering, in order to remove the earth sufficiently for the insertion of the ends of the poles into the ground.

Hop-*Oast*. See *Oast*.

Hop-*Picker*, a person employed for picking hops from the bind.

Hop-*Poles*, the stakes, or poles, which are fixed into the ground for the purpose of the binds climbing up, and twisting round them.

It is observed by Mr. Marshall, in his account of the Southern Counties, that "the species of woods in use for hop-poles are various. Formerly, they depended much on the natural growth of the coppice woods of the country. But of late years, it has been the practice to make plantations for the especial purpose of hop-poles."

The following is the order in which they are esteemed by the planters in that district:

1 The chesnut,	6 The maple,
2 The ash,	7 The oak,
3 The sallow,	8 The hornbeam,
4 The red willow,	9 The beech.
5 The birch,	

It is suggested, on the authority of a judicious manager, that this, as well as other climbing plants, may have a choice "with respect to different species of woods as supporters; and that they may prefer a rough soft bark, to one which is more smooth and polished. He particularizes the maple, whose bark is peculiarly "soft and warm;" adding, that he has frequently observed, when the morning has been cold, the sensitive leader of a tender fresh-poled vine reclining its head against the velvet bark of the maple, while others held their's aloof, from chilly smooth-barked poles. This is probably a general law, or ordinance of nature, to climbing plants; and may be essential to their preservation, showing, in a palpable manner, the perception and strength of vegetable instinct."

And that, in regard to the size of the pole, "hops, likewise, it is well known, he says, have their instinctive choice or approbation, with respect to the thickness of their support; embracing, with greater readiness, a pole that is moderately small, than one which is thick at the bottom. The ordinary circumference of poles, at the thickest end, may be set down at six to nine inches, tapering to the size of a walking-cane at the top." And "the length runs from fifteen to twenty feet, or upwards: he has measured new poles of twenty-two feet in length. Different grounds require different lengths of pole. In the rich grounds, in the neighbourhood of Maidstone, the poles of grown hops stand, in general, from fourteen to sixteen feet above the hills, and have from eighteen inches to two feet beneath the surface. But, on weaker lands, poles are not seen to rise more than ten to twelve feet high. Hence, a variety of ground is convenient; as the poles, by decaying at the roots, grow shorter, and, in a course of years, get too short for strong vines, on rich land. Yet he has met with no instance in which they are, in this case, sold and transferred to less productive lands, and vines of humbler growth."

It is stated, that "the price of poles in this district varied, in 1790, from fourteen to forty shillings a hundred, according to size and quality; they being usually divided into three sorts;—*firsts*, *seconds*, and *thirds*. In 1797, the price had fallen; prime poles being then thirty shillings." But they have, since that, become very scarce, and of course much higher in price.

The "new poles have sometimes the bark shaved off, under an idea that it saves them from the worm; while some men are of opinion, that there is a warmth in the bark, which is acceptable to the young vines; and although in two or three years the bark drop off, the surface of the wood has, by that time, acquired a degree of softness. Admitting that a hard, smooth, polished pole, is unfriendly to the hop, to peel the poles would evidently be improper."

In pointing, the "short light poles are usually pointed in hand, without other support. But the tall heavy pole requires something to keep the top steady. This is simply had, by tying together three poles of equal length, two or three feet from their tops; and setting them up in the form of what are called triangles, in use for loading timber on wheel-carriages. The top of the pole to be sharpened, being dropped in between the points or horns of the triangles, receives the required stay; a block being placed in a convenient situation below, to work upon." And this sort of work, "whether on new or on old poles, is sometimes done before they are *stacked*, or set up in piles; sometimes immediately before they are used." But "in pointing poles that have been used, the part which stood in the ground the preceding year is struck off, if much tainted, and a fresh point given to the sound part. But, if the bottom part remain firm, it is sharpened again for another season."

In respect to the stacking the poles, it "is a work that commences presently after the picking is finished.

In West Kent, the poles are universally, he believes, set up in somewhat conical piles, or congeries, of two to five hundred each. The method of proceeding is this: three stout poles, of equal length, are bound together, a few feet from their tops, and their feet spread out, as those already mentioned for pointing the poles. These serve as a stay to the embryo pile; the poles being dropped in on each side, between the points of the first three; cautiously keeping an equal weight on every side: for, on this even balance, the stability of the stack depends. The degree of inclination or slope, and the diameter of the base of the pile, vary with the length and the number of poles set up together. A stack of three or four hundred of the long poles of the environs of Maidstone, occupy a circle of near twenty feet in diameter. It is observable, however, that the feet of the poles do not form one entire ring; but are collected in bundles, or distinct divisions; generally from three to six or eight in number: each fassiculus being bound tightly together, a few feet from the ground, with a large rough rope made of twisted vines, to prevent the wind from tearing away the poles; and the openings between the divisions give passage to violent blasts, and tend to prevent the piles from being thrown down in a body; a circumstance which does not often, he believes, take place in skreened grounds. But, on the high exposure of Cox Heath, where great quantities of new poles brought out of the Weald are piled for sale among the Maidstone planters, it is not uncommon for the piles to be blown down, and to crush in their fall the sheep or other animals that may have taken shelter under them. A caution, this, to the inexperienced in the business of stacking; and an apology, if one is wanted, for the minuteness of the detail."

It is added, that "the duration of hop-poles depends on the species of wood, and its growth; and this, on the quality of soil, and the exposure on which it grows. Chesnut poles, of eighteen or twenty years growth, are esteemed the most durable of all others. A pole of this description (it is asserted with confidence) was continued in a hop-ground in that district upwards of thirty years; being regularly marked each year. The ordinary duration of poles is from five to twelve years."

In regard to the disposal of refuse poles, "when they are no longer useful for vigorous plants, they are either transferred to those of lower growth, or laid by for young plantations; being finally converted to fuel, or burnt into charcoal, to mix with coke, in the operation of drying the crop. For either of these purposes, they are worth about five shillings a hundred."

It is observed, that "the annual expense of poles, reckoning new poles at thirty shillings, the number employed on an acre at three thousand, the duration eight years, and the value of refuse poles at five shillings a hundred, will amount to about five pounds an acre." And that, from "this great expense of poles, and that it chiefly arises from the decaying of the part inserted in the ground, as well as the mischief which not unfrequently happens from the loaded poles being broken off at the ground by high winds, while the crop is maturing; it appears to be a thing most desirable, to prevent or check the decay of that part. And nothing seems so likely, he suggests, to effect this, as *charring* the bottoms of the poles; especially the part which is placed between air and moisture, at the surface of the ground; where the decay mostly takes place. See *Charring of Posts.*

Hop-*Shim*, an implement constructed with a frame, somewhat in the manner of the common wheelbarrow, and which has feet or teeth, which cut up or drag out such weeds as may be present, at the same time that they pulverise and prepare the ground. In the Report of the Agriculture of the County of Kent, it is observed, that this implement may be advantageously employed for clearing summer-fallows from weeds; and, when well made, it costs about two guineas.

Hop-*Clover*, a plant of the clover kind, which grows naturally in most dry meadows and fields of the pasture kinds where it usually flowers in June and July. It has been lately advised as useful in laying down lands to grass, in mixture with other grass-seeds; and, on the lighter sorts of soils, is said to afford excellent fodder.

Hop-*Trefoil*, another name sometimes applied to the above plant.

HOPPER, the basket in which the seed is carried during the time of sowing.

HOPPLE, a term signifying to fetter, by tying the fore legs together in a loose manner.

HORN, a substance of the hard corneous kind, which, where it can be procured in sufficient quantity, is found to be of much use as a manure.

Horn *Shavings*, the small pieces of waste horny matter produced in different manufactures. All sorts of refuse of this nature is found of great benefit when made use of as manure. There are two sorts of these matters made use of in Hertfordshire, the *small* or turners' shavings, and the *large* or refuse pieces of horn. The first of these sorts are purchased in London at about 13*s.* or 14*s.* the quarter, or ten-bushel sack stuffed full, mostly weighing about two hundred and a half. But the large shavings cost about 2*s.* less per quarter. Horn-shavings are used in the same way and quantities as furriers' clippings, except that they want no pricking in, and the large are generally ploughed into the land three months before sowing wheat or barley. Horn-shavings answer in most soils and seasons, except very dry ones, when they will not work. The small shavings are much the most useful and effectual as a manure. See *Manure.*

Horn-*Hipped*, a term used in horsemanship to signify the croup.

HORNED, a word used to signify the goring or wounding with the horn.

Horned *Cattle*, a term frequently applied to neat-cattle.

HORNS, the well-known ornaments growing from the heads of cattle, sheep, and some other sorts of animals. There is much disadvantage in

animals having too much of these ornaments; of course the polled breeds should be more attended to and encouraged. See *Breeding*.

HORNBEAM, the name of a tree of the deciduous kind, sometimes cultivated as timber, being employed in turning, and for mill-cogs, &c. There are only two species of this tree, the *common hornbeam*, and *hop hornbeam*; but it has three varieties, the *Eastern hornbeam*, *flowering hornbeam*, *American hornbeam*.

According to Mr. Marshall, the common hornbeam is a native of Europe and America; and the hop-hornbeam a native of Italy and of Virginia. The first, it is said, will grow so high as sixty or seventy feet: we seldom see it, however, arrive at so great a height. Its leaves are of a darkish green, and about the size of those of the beech, but more pointed, and deeply serrated. Its branches are long, flexible, and crooked; yet, in their general appearance, very much resemble those of the beech: indeed, there is so great a likeness between those two trees, especially in the shrubby underwood state, that it would be difficult to distinguish them at the first glance, were it not for that glossy varnish with which the leaves of the beech are strongly marked. Mr. Marshall says, that, "as an underwood, it affords stakes and edders, fuel and charcoal. Its timber ranks with that of beech and the sycamore. The only superior excellency of the hornbeam lies in its fitness for *skreen-fences;* for sheltering gardens, nurseries, and young plantations, from the severities of the winter-season. It may be trained to almost any height, and, by keeping it trimmed on the sides, it becomes thick of branchlets, and consequently thick of leaves; which being by their nature retained upon the plant after they wither, a hornbeam-hedge occasions a degree of shelter nearly equal to that given by a brick wall. Indeed, being less reflective than that *expensive* screen, it affords a more uniform temperature of air to the plants which stand near it. In this point of view, too, the hornbeam is useful to be planted promiscuously, or in alternate rows, amongst more tender plants in exposed situations, in the same manner as the birch; to which it has more than one preference; namely, it is warmer in winter."

The same writer says, that the *Eastern hornbeam* arrives to the least height of all the sorts: about ten feet is the farthest of its growth, and it looks pretty enough with trees of the same growth. The leaves are by no means so large, as the branches are always closer in proportion to the smallness of the leaves. Where a low hedge is wanted of the deciduous kind, this would not be an improper tree for the purpose, either to be kept sheered, or suffered to grow in its natural state. The bark of this sort is more spotted than that of the common.

With respect to the *flowering hornbeam*, it is the most free shooter of any of the sorts; and will arrive to be the highest, the common hornbeam only excepted. It will grow to be thirty or forty feet high. The branches of this tree are less spotted with greyish spots than any of the other sorts. The leaves are very rough, of a dark green colour, and are longer than the common sort. The property which the common hornbeam is possessed of, of retaining its leaves all winter, does not belong to this sort, the leaves of which constantly fall off in the autumn with other deciduous trees.

The *American hornbeam* is a more elegant tree than any of the former sorts. The branches are less slender, covered with a brownish speckled bark, and are most sparingly sent forth than from any of the others. The leaves are oblong, pointed, and of a palish green colour, and are not nearly so rough as the common hornbeam, though the flowers and fruit are produced in the same manner.

The second species, or the *hop-hornbeam*, is of taller growth than the Eastern kind. It will arrive to the height of twenty feet or more. The leaves are nearly the size of the common sort, and some people admire this tree on account of the singular appearance it makes with seeds, before they begin to fall. There is a variety of this tree, which grows to thirty feet high, shoots freely, has long rough leaves, like those of the elm, and longish yellow coloured flowers, called the *Virginian flowering hop-hornbeam.*

In regard to the culture of these trees, the first, or common hornbeam, may be propagated either by layering (at almost any time of the year), or from seeds, in the following manner:—In the autumn, the seeds will be ripe, when, having gathered a sufficient quantity for the purpose, let them be spread upon a mat a few days to dry. After this they should be sown in the seminary ground, in beds four feet wide, with an alley about two feet, and from one to two inches deep. In this bed, they must remain till the second spring, before they make their appearance, and all the summer they lie concealed: the weeds should constantly be plucked up as soon as they peep; for if they are neglected, they will get so strong, and the fibres of their roots will be so far struck down among the seeds, as to endanger the drawing many seeds out with them on weeding the ground. After the young plants appear, they should constantly be kept clear of weeds during the next summer; and if they were to be now and then gently refreshed with water in dry weather, it would prove serviceable to them. In the spring following, they may be taken out of these beds, and planted in the nursery, in which situation they may remain till they are of a sufficient size to plant out for standards.

All these different sorts, the above writer says, may be increased or raised by layers; for which purpose a few plants for stools must be procured. The stools of the Eastern hornbeam should be planted a yard, and the other sorts a yard and a half, or two yards asunder. After these plants have made some young shoots, they should be layered in the autumn, and by that time twelve month they will have struck root; at which time, or any time in the winter, or early in the spring, they should be taken off, and planted in the nursery way, observing always to brush up the stool, that it may afford fine young shoots for fresh layering by the autumn following. The dis-

tance the plants should be allowed in the nursery need not be more than one foot, in rows that are two feet asunder; and here they may stand, with the usual nursery care of weeding and digging the rows in winter, until they are to be finally planted out; though the Virginian hornbeam will frequently send forth two shoots, which will seem to strive for mastery in the lead. When this is observed, the weakest should always be taken away, otherwise the tree will grow forked, and not be so valuable.

HORSE, a well-known animal of the quadruped kind.

This is an animal that has at all periods been considered of great utility and importance to mankind, and ranked in the first class of the quadruped kind. The diversities that are known to exist among those useful and elegant creatures are extremely numerous, though but few experiments have been made to direct the steps of the inquirer in investigating them.

It is observed by Buffon, in his Natural History of Quadrupeds, that the finest horses known in Europe are the Arabian: they are larger and fuller than the Barbs, and not inferior to them in shape. But as few of them are met with, many observations have not been made either on their perfections or defects.

Dr. Anderson, however, remarks, in his Recreations, &c. that some Arabian horses have been introduced into this country; but we have little occasion to put them to the trial here respecting that quality for which they are chiefly valued in their native country, that of being able to endure abstinence and fatigue for a long period without succumbing. Swiftness of foot, and strength of wind during the short career of a horse-race, is all we look for in those light-bodied nimble horses, to the improving of which our adventurous breeders have attached themselves for several ages; and in this effort they have been so successful as to be now, perhaps, without a rival on the globe; for, in regard to swiftness for a spurt, he is inclined to believe that the English-bred horses of this kind exceed all others.

The Barbs, the first-mentioned writer says, are more common; their chest is long and slender, rises beautifully from the withers, has little mane, the head well shaped, small, and lean; the ears handsome and well placed; the shoulders flat and slender; the withers narrow and plump; the back straight and short; the flank and sides round, and not bellying out; the haunches firm and well shaped; the croup or breech generally somewhat long, and the tail pretty high placed; the thigh well shaped, and seldom flat; the legs handsome, well shaped, and without hair at the pastern joint; the foot well made; but the pastern often long. They are of all colours, but generally brown. The Barbs are something negligent in their going; but, properly encouraged, show an amazing swiftness and vigour: they are very light and fit for running; and seem, of all others, the fittest to breed from. It were, however, to be wished, he thinks, that they were a taller size, the very largest being only fourteen hands; and one of fourteen hands and an inch is very extraordinary. Experience has, however, shown, that in France, England, &c. they get colts larger than themselves. Among the Barbs, those of the kingdom of Morocco are accounted the best, except the mountain Barbs. Those of the rest of Mauritania are inferior to them, as are also those of Turkey, Persia, and Armenia.

All those horses which come from a hot climate have a smoother coat than our own breeds. The Turkish horses are not so well proportioned as the Barbs: the neck slim, a long body, and the feet too slender; but are very laborious and long winded. Nor will this, says he, appear strange, if it be considered that in hot countries the bones of animals are harder than in the cold; and for this reason it is, that though their shank-bones are smaller than the horses of this country, yet their legs are stronger.

The Spanish horses, which are, he says, placed next to the Barbs in point of rank, have a long thick neck, with a large mane; the head full large, and sometimes the fore-top large; the ears long, but well placed; the eyes full of fire, and the air noble and spirited; the shoulders thick, and the chest broad; the back often something low; the ribs round, but the belly often too large; the croup generally round and large, though in some longish; the legs beautiful and without hair; the sinew well detached; the pastern sometimes longish, like the Barbs; the foot a little lengthened, like that of a mule; and the heel often too high. The fine-bred Spanish horses are plump, well-set, and place the legs well on the ground: they have also a great deal of motion in their paces; great agility, fire, and stateliness. Their coat is generally black, or a light chesnut; though there are some of all the usual colours. But it is very seldom that any are seen with white legs or muzzles; the Spaniards having such a dislike to these marks that they never breed from horses which have them. A star on the forehead is all they require; but they value horses of one dark colour as much as we despise them: both these prejudices, though opposite, are perhaps equally ill founded, there being some very good horses of all kinds of marks, and some excellent among those which are all of one colour. This minute difference does not proceed from the nature or constitution of the horse; but from an external, and at the same time so superficial a quality, that a slight wound in the skin is sufficient to produce it. Further, the Spanish horses, whether entirely of one colour or not, are all marked on the off thigh with the mark of the stud where they were bred. They are not usually large-sized; though some rise to fourteen hands and one or two inches. Those of Upper Andalusia are esteemed the best of all; though they are apt to have the head too long: but this blemish is overlooked in consideration of their excellent qualities; as courage, gracefulness, obedience, ambition; and in activity they even exceed the Barbs. These advantages, he says, recommend them above all other horses in the world, whether for war, state, or the manège.

The finest English horses, he observes, greatly re-

semble the Arabians and Barbs in shape; indeed they owe their origin to them: but the head is much larger, though well made, and has a fine fore-top; the ears longer, but properly placed. By the ears alone an English horse may, however, be distinguished from the Barb; but the greater difference is in the size, the English horses being much larger and better set. Their common height is fourteen hands two inches, and even fifteen hands is not very extraordinary. They are of all colours, and all marks; are generally strong, mettlesome, bold, bearing great fatigue, excellent for hunting and racing, but want air and agility: they are stiff, and have little freedom in their shoulders.

The Italian horses were formerly, he says, much finer than at present, the studs having been neglected there for some time. The kingdom of Naples, however, still affords fine horses, especially for carriages; but they have, in general, large heads and thick necks: they are also untractable, consequently are difficult to be trained. These defects are, however, in some measure compensated by the largeness of their size, their spirit, and the beauty of their motions. They are excellent for parade, and very much affect stateliness.

The Danish horses are of such a large size, and so well set, that they were formerly preferred to all others for coach-horses. Some are perfectly well moulded, though in general their formation is not very regular; most of them having a thick neck, broad shoulders, the back a little too long and low, and the croup too contracted for the breadth of the chest; but they all move well, and are in general excellent for war and state. They are of all colours, even the most uncommon; the pyed and spotted being seldom seen but in Danish horses.

It is also observed that Germany affords some fine horses, but that the generality are heavy and thick winded; though most of them come from Turkish and Barbary horses, of which there are many studs; as also of Spanish and Indian horses: thus they make no figure in hunting and racing; whereas the horses of Hungary, Transylvania, &c. are very light and fleet. The Hussars and Hungarians are said to slit their nostrils, with a view, it is asserted, to mend their wind, and at the same time prevent their neighing in the field; it being affirmed that horses whose nostrils have been slit cannot neigh. It has not indeed been in his power to examine this particular; but it seems natural to think, he says, that the operation can only weaken their neighing. The Hungarian, Croatian, and Polish horses are noted for having what is called the mark in all their fore teeth, which continues to old age.

The Dutch horses are said to be very good for coaches, and are most commonly used in France. The best come from Friesland. The countries of Bergue and Juliers also breed very good ones. The Flemish horses are far inferior, he says, to those of Holland: they have generally large heads, broad feet, and their legs subject to dropsical swellings. The two latter are capital faults in coach as well as other horses.

It is stated, that France produces horses of all kinds, but not many which may be called fine. The best saddle-horses come from the Limosin, being something like the Barb, and excellent hunters, but of a slow growth. They must not, he says, be broken young, nor put to any service till they are eight years old. Auvergne, Poitou, and the territory of Morvant, in Burgundy, also produce very good ponies. But Normandy, next to Limosin, affords the finest horses; and if not such excellent hunters, they are preferable to the rest for war, are better set, and sooner trained. Lower Nomandy and Cotentin are, he adds, famous for very fine coach-horses: they are lighter and more sprightly than the Dutch horses. Franche Comte and the Boulonnois furnish very good draught-horses; but a general fault in the French horses is, he remarks, the width of their shoulders; whereas those of the Barbs are too much contracted.

It is remarked, by the author of Modern Agriculture, that it is commonly supposed that there are only two distinct breeds of horses in this country:—the *race*, or *blood* sort; and the *cart*, or *plough* horse. Some have, however, imagined the small poney common in the mountains of Wales, and in the northern parts of Scotland, to be a distinct breed from the other two. This is, probably, not the case, the same writer thinks, as the only perceptible difference between them and the ordinary cart-horse of England, and the south of Scotland, is in the size; and this may be accounted for, it is thought, in a very satisfactory manner, by observing, that these small horses are bred in cold, rainy, mountainous districts; that they are reared without attention; and that, when broken into work, they are treated and fed with the greatest degree of carelessness and neglect.

And it may be further noticed, that the long-established practice of importing stallions and mares from the Continent, and of crossing these with the ancient breed of the country, has been the means of producing as many varieties in the size as in the proportion and temper of the British horses. Some are, consequently, adapted for running with great swiftness; others for travelling, hunting, &c.; others for war; and others for draught. It is the last sort, or those which are chiefly employed in the operations of husbandry, that are principally to be considered here.

The names by which the different breeds of farm-horses are generally distinguished in this country are the following: The *black cart-horse*, which is shown at *fig.* 1. in *pl.* LIV.; the *Cleveland bay*; the *Suffolk punch*, which is shown at *fig.* 2.; and the *Welch poney*.

The most important particulars in which each of the above breeds, or rather the varieties that have sprung from the two original breeds, differ from each other, are these:—The black cart-horse, which is the common breed of some parts of the counties of Lincoln and York, and general in the counties of Leicester, Stafford, Derby, and Warwick, is in size superior to any other in the kingdom; naturally in-

active, and slow in motion; clumsy, and frequently ill-proportioned; infinitely better adapted for drawing ponderous loads on the pavements in large towns than for ploughing and harrowing, or for performing any of the other operations connected with husbandry. In regard to this breed, Mr. Marshall has remarked, in his Rural Economy of Yorkshire, that the breed of grey rats, with which this island has of late years been over-run, is not a greater pest than the breed of black fen horses.

It is added, by the author first mentioned, that the largest of this breed are mostly employed in London, and other cities, as dray-horses. The next size are generally made use of in husbandry, and as coach-horses; and the smallest are bought up and trained for military purposes. Dr. Anderson well observes, that the large black dray-horses, in point of size and fatness, do not, that he knows of, admit of any equal; though, in point of hardiness, vivacity, and nervous energy, they rank, perhaps, among the lowest of their species.

The second sort, or the Cleveland bays, are clean well-made animals; very strong and active; and equally in request for the coach, the saddle, and the plough. They are capable of both great and long-continued exertion. Vast numbers of this breed are annually sold, when young, at the fairs in the district from which their name is taken, or in the neighbourhood; the strongest and best being mostly used as coach-horses; those of lighter bone for the saddle, and the remainder in the plough, cart, or other team.

The Suffolk punch, when of the genuine breed, is a short plain-looking horse, very compact, and more active and hardy than any other in the southern parts of the kingdom. This breed, it is observed, has been much improved of late. The Suffolk horses are, however, when compared with the breeds mentioned above, of but a small size, not exceeding fifteen or fifteen and a half hands in height; but so active, that the farmers in that county and in Norfolk very commonly plough two acres a-day in the busy seasons with a pair of these horses. They are chiefly employed in the operations of husbandry by the farmers in the more southern districts of the kingdom. They require good and substantial food; but, when properly treated, pay well for it by their services.

In addition to the above kinds of horses, there are three sorts, it is remarked, in Wales, or more properly horses of three different sizes: as the Welch poneys, the larger breed of the country, and a cross breed between stallions from England and the country mares. The first are very diminutive, and it may be added very useless animals, fit only for carrying light weights, although sometimes employed in conveying coals, &c. in baskets, to the towns in the neighbourhood. The second sort, though remarkably hardy, are below the proper size that ought to be employed in draught; and, being in general ill-shaped, are comparatively of but little value. The third may be described as being stout, active, hardy, well-shaped, and easily reared. They are commonly about fifteen hands high; and upon the whole, considering the state of agriculture in that country, probably, Mr. Donaldson thinks, as perfect a breed as ought to be introduced for a considerable time to come.

And it is further added, that though Scotland cannot probably boast of as valuable breeds of farm-horses as England, it may at least contend for possessing as great varieties. It has the *Lanark* or *Clydesdale*; the *Garron*; the *Galloway*; and the *small Highland horses*.

The same author remarks, that Lanark is the only county in Scotland which can be said to possess a valuable breed of plough-horses; the reason of which is ascribed to an adventitious circumstance that happened in that district about the end of the seventeenth century; which was, that one of the dukes of Hamilton brought over six coach-horses (stallions) from Flanders. By crossing these with the best of the country mares, the breed, now so well known by the name of the Clydesdale, was, it is said, produced. Mr. Donaldson conceives that the Clydesdale horses are probably inferior to none in the island, either for the cart or the plough. They are, he says, from fifteen to sixteen hands and a half high; strong, active, and steady in harness. From Clydesdale and some of the neighbouring districts the farmers in the south and south-east parts of Scotland are mostly supplied with horses. Many are sold for the coach and the saddle; and considerable numbers are also sent into England for the purpose of riding as well as draught.

It is observed, by Dr. Anderson, that the Lanark horse is lighter in the body than the Suffolk punch, and more elegantly formed in all respects. His limbs are clean and sinewy; his neck longer, his head of a finer form, and his eye more sprightly and animated than either of the former breeds. His tread is firm, though tending towards the nimble; and he is capable of exerting a wonderful degree of muscular strength for a short push, without being hurt by it, which makes him peculiarly valuable for that hilly country, where there is a necessity of calling forth such exertions on innumerable occasions. He is hardy, can live upon any food, and is perhaps the thriftiest horse for cart or plough that is to be found in the island—perhaps on the globe itself. For these purposes he is peculiarly adapted by the evenness of his temper, and the steadiness of his movements. For the plough, perhaps, he is every thing that could be wished; being, in point of size, neither so large nor so unwieldy as to render him a burden to the soil: two of these horses, in the stiffest soil, under good management, being perfectly able to draw a full furrow with ease; and for horse-hoeing, or ploughing a light soil in good order, one of the lightest sort performs the work with alacrity and ease. What a benefit, says he, would result to this nation, were a set of judicious experiments to be conducted for a sufficient length of time, for the purpose of ascertaining the comparative powers and expense of keep of these three different breeds of horses, so as that any one that chose it might know with cer-

tainty the profit or the loss that would result to him from employing the one or the other for any particular purpose that he had in view!

It is stated, by Mr. Donaldson, that the garrons are the ancient breed of country horses, without having been improved by crossing with other breeds. Horses of this description are, it is observed, still common in those cultivated districts which lie adjacent to the mountains, and where the more improved modes of husbandry have not been generally introduced. They are a strong hardy race, rather under the middle size, and partaking more of the form of the Suffolk punch than of the clean-boned fine-shaped Cleveland bay. They measure about fourteen or fourteen hands and a half in height; and with due attention might be rendered a very valuable breed for different uses.

The Galloway breed of horses are, it is remarked, much about the height of those just mentioned, but superior in shape, and lighter in bone. They are, it is asserted, extremely well calculated for the road, as they move easily, and are capable of enduring very great fatigue. This superiority is said to be owing to the following circumstance:—Some ships of the Spanish Armada, loaded with horses, having been wrecked on the coast of Galloway, several stallions were thrown ashore. These, having been crossed with the country mares, produced the breed so well known under the name of Scotch Galloways, but which, owing to inattention, is said now to be greatly degenerated in various respects.

Dr. Anderson indeed remarks, that this breed is now nearly extinct in Scotland; which is much to be regretted; for could a sufficient number of these horses be obtained to make a proper selection from among them for breeding from, it is difficult to say to what degree of excellence they might in time be raised. By a judicious cross, also, their size might be improved without much abating their other qualities. A cross between these and the Lanark breed would have been admirable for many uses, particularly for the plough, in a district occupied by good farmers. In the island of Mull, on the west coast of Scotland, some remains of this breed are still to be found, though they are so much neglected as to be fast degenerating by intermixture with other inferior breeds, as has been just observed.

And it may, Mr. Donaldson says, be observed, that there are two sorts of horses in the Highlands of Scotland: the smallest is to be found in Shetland, Orkney, Caithness, and the western islands. They are seldom above nine or ten hands high; and, though hardy, are, like the small Welch poneys, very useless animals, being too small for the plough, or indeed for performing properly any operation of husbandry. The other sort is common in the highlands of Perth, Argyle, Aberdeen, and Inverness. They are considerably larger, being between thirteen and fourteen hands; but as no attention is bestowed on improving the breed, and as they are miserably mismanaged in every stage of life, they cannot, Mr. Donaldson says, be considered either as a valuable or profitable stock for either the farmer or breeder.

Dr. Anderson adds, however, that in form they are superlatively elegant: their body is much thicker and more compact than that of a blood-horse; the muscles of the thigh and shoulder diminish gradually as they descend, till near the pastern they are as small and sinewy as that of the blood-horse; their pasterns, however, nothing near so lax, but firm and sinewy; the hoof firm and tough. The neck, towards the shoulders, is also firm, but towards the head it is small; and the head itself clean and light, with an eye that indicates health, strength, and animation. Could a horse of this kind be found of the size of one of the London drays, it would be an animal of inestimable value; yet this creature, because its size is small, is neglected, and will probably be suffered to become extinct; as if it were not in the power of man, by judicious management, to raise this breed gradually to a larger size, and thus obtain an excellence among this species of creatures that has been hitherto deemed unattainable, merely because we have chosen to pamper and encourage more large and lubberly breeds of horses. Were he required to sketch out a model for a horse that were to possess in the highest degree strength of body and lightness of movement united, he should take the picture of one of these. He has seen some of this breed that scarcely exceeded three feet in height, but would have carried a man of twelve stone weight a journey of forty miles in one day with ease: he need therefore say nothing more of their strength and activity.

The following is the description of a well-formed horse, as given by Mr. Cully, an eminent breeder, who observes that, whatever be the variety of the breed, the form should be this:—"His head as small as the proportion of the animal will admit; his nostrils expanded, and muzzle fine; his eyes cheerful and prominent; his ears small, upright, and placed near together; his neck, rising out from between his shoulders with an easy tapering curve, must join gracefully to the head; his shoulders, being well thrown back, must also go into his neck (at what is called the points) unperceived, which perhaps facilitates the going much more than the narrow shoulder; the arm, or fore-thigh, should be muscular, and tapering from the shoulder, meet with a fine, straight, sinewy, and boney leg; the hoof circular, and wide at the heel; his chest deep, and full at the girth; his loin or fillets broad and straight, and body round; his hips or hooks by no means wide, but quarters long, and tail set on so as to be nearly in the same right line as his back; his thighs strong and muscular; his legs clean and fine boned; the leg-bones not round, but what is called *lathy* or flat."

The chief points in a farming cart-horse, in the opinion of the author of the New Farmer's Calendar, are:—"Neck not long, nor too thick; short legs, rather flat than round and gummy; fore-feet even, not too distant; wide chest; strong, but not high, shoulders; considerable length of waist, supported by a wide loin; quarters full, and rather raised; strong muscular thigh; size, fifteen hands one inch, to sixteen hands high. Being somewhat

forelow, gives them an advantage in draught; and a moderate length of waist insures speed in the walk, very often an object of consequence upon a farm. Care being taken to breed their heads light, handsome, and well set on, the stallions, or mares, with a proper cross, may produce high-priced coach or cavalry horses. To raise a breed of the above description for sale would, he thinks, pay exceedingly well. To breed a good horse costs no more, except of skill, than to breed a bad one: But what a difference in the market-price! Cart-colts are ready for sale very early, as every one knows. Coach-horses may be made from mares of the Suffolk breeds, covered by a strong racer or hunter, or *vice versa*. Should a farmer desire to breed chapman's horses, or hacks, for sale, he will succeed best, he thinks, by choosing both mare and horse of the fashionable hackney kind, that is to say, each having some blood; it is preferable to his having recourse to a thorough-bred horse, for reasons he has not room to detail. Breed them, says he, with light heads, well set on; good feet and even, close before, wide behind; plenty of bone under the knee, and high, deep, and slanting shoulders; deep in the girth, handsomely rounded in the barrel and on the hip-bones; straight in the back, but the waste long enough to give speed, with the loins and fillets strong in proportion; tail level with the back-bone. Instead of breeding, a farmer, who desires to profit by this kind of stock, may, he supposes, always find colts and fillies enough for his money."

In regard to the properties of a breeding mare, she should, Mr. Donaldson thinks, be well-shaped; possess a gentle disposition; have a large carcase, conformably to her height; be pretty full bellied, and likely to become a good nurse, or have plenty of milk. The mare which is intended to supply the team with draught-colts should, according to the author of the Synopsis of Husbandry, be large limbed, close jointed, short necked, wide chested, home ribbed, with a capacious body; her eyes should be clear, full, and pellucid, and her nostrils large and open; in disposition she ought to be gentle and tractable; of a constitution healthy and vigorous, free from any blemishes either hereditary or acquired. The horse should be bold and spirited, well made, and of a kindly disposition; his constitution should be strong, his temper good, and, in short, neither in mind nor body ought he to be contaminated with vices or disease of any kind; since on the good qualities and strength of constitution in the sire and the dam depends, in a great measure, the future welfare of the colt.

In common it is, Mr. Donaldson says, too much the practice to be more attentive in the choice of a stallion than of a breeding mare. This conduct is, he thinks, improper, in so far as it is known, from general experience, that, in regard to form, and other good qualities in the progeny, more depends on the mare than on the horse. It is always of importance to make choice of a stallion as similar in colour and form to those of the mare as possible: by following this method, it is conceived, there is much greater probability that the foal will possess the joint properties both of father and mother, and turn out more agreeable to the wishes of the owner, than when violent crosses are attempted. But when a half-bred mare, for instance, is put to a great heavy clumsy cart-horse, or *vice versa*, the stock turns out a kind of mongrel or bastard breed, seldom possessing, in any considerable degree, the strength or size of the one, or the spirit, activity, and fine bone of the other. In short it is concluded, that although crossing the breeds of horses has upon the whole been productive of good consequences, notwithstanding it has been often injudiciously conducted, yet those who have adhered to the rule above mentioned will be found, in every instance, to have proceeded furthest on the road to perfection. If, says the same author, the great cumbrous cart-horse of Lincolnshire be found too large in size, and too slow in motion for performing the operations in ploughing, harrowing, &c. with the requisite expedition, why attempt to reduce his size or increase his activity, by unnatural crossing with the smaller, more spirited, and more useful breeds of other districts? The better way would be, says he, to make choice of a breed possessing naturally the greatest number of the wished-for qualifications, to which, by proper management, might also be added by degrees, and with infinitely more certainty, any particular properties which were deemed wanting.

The writer of the Experienced Farmer thinks that the horse used in husbandry ought to be larger, but in other respects like the road-horse; and, instead of walking two or three miles an hour, be able to walk four or five. In that case, he would be able both to plough more land in a given time, and work in the cart or waggon with more dispatch, when wanted. In harvest time, a nimble and strong horse is valuable. In drawing manure into the field, or corn to market, the farmer will also find his account in strength and activity; for, as the draught in all these cases is light one way, such horses would do their business with speed. The small farmer need not with this kind of horse keep an idle one; he might carry his master to market, and plough the remainder of the week. This is the sort of horse proper for a gentleman's heavy coach: therefore, if the farmer should determine to breed, and take a little pains to rear horses of bone and action, it would not only prove advantageous to himself, but useful to the public. These horses should be bred to be from fifteen to sixteen hands high; should walk light five miles an hour, trot twelve; and if one now and then turned out rather low, he would notwithstanding fetch a good deal of money for carrying some heavy gentleman. Horses of this description are, he says, hardy, and require less food to support them than the long-waisted washy things of fashion, which some half connoisseurs in horse-flesh are so fond of. The general opinion is, that, if a horse is put to draw, it will make him stumble. If he is over-weighted and worn down, this possibly

may be true; but keep a horse above his work, and he will be no worse for the saddle. He has had a proof of this in a mare which he now rides.

The road-horse should, in his opinion, have a small head, a quick eye, with a rising forehand or neck; his shoulder to be cast into his back; not very fine in the chine. His back must be straight, not over short. Let him be high in his ribs, and straight in his hind-quarters; his hucks lying close or round with his rib, and his tail standing straight with his quarter; thick in his thigh, and broad in his breast; short in his legs, with his fetlock very short; a good round hoof, not over steep. He should rather stand a little out with his fore toes, and his hind feet the same; for by that position he is both stronger and safer. He cannot move with one leg too near the other, provided he does not cut; for when a horse moves, he must have two legs off the ground; therefore, by keeping his legs near each other, he is stronger. By one leg on the ground being perpendicular, and his toes standing a little out, he is much safer: if he makes a trip, he does not so soon lose his balance, or get over his knee. The shorter he steps the better, if he is but quick (for light moving is equal to strength); and by keeping his legs under him, he does not tire like a horse who oversteps and fatigues himself. Nor does he beat the ground so hard; so that his feet and legs last much longer.

Drays, says he, require the slowest movement in a horse. The burdens are generally excessively heavy; in London streets particularly, where no swiftness, but great power, is required to move the immense weights drays are often loaded with. Horses for this purpose, therefore, should be very broad-breasted, and thick in the shoulders, which should not lie backward. Nor should the fore-hand be up, as recommended in the road-horse; for, by holding up their heads, they would be choked by the collar, as they would, if so formed, draw too much by the throat, and, their wind being thus stopped, would be in danger of falling down. The neck of a dray-horse is not the better for being long. If his head be small, he is likely to be of better thrift; but then, on the other hand, a small head is sometimes a sign of a lively spirit, which makes a horse not steady in drawing; and it is a great fault in a dray-horse to be quick or hasty in temper. Like all horses, he should be chosen with short legs, and good strong hoofs. He ought to be thick in his thighs, and large in bone: but he can see no necessity for that great quantity of hair so frequently met with upon the legs of these animals. He is of opinion, that, in respect to use, he would be better without that superfluous ornament; but perhaps the dealer would not give so good a price for him without the hair as with it; therefore, as breeders, like other men, must look to their profit, they will, no doubt, continue to raise such horses as will fetch most at market, and think more of show than of real use; for a redundancy of hair is not a sure indication of strength. Most of the observations laid down respecting the dray-horse are equally applicable to the stage-waggon horse. His shape and make, however, must not be exactly the same; for, as the waggon-horse is required to travel, he must partake of the nature both of the true dray-horse, which originally was a native of Flanders, and of the true English coach-horse, a breed unknown any where but in this island. A quicker movement is required for a stage-waggon than for a dray, and something more of spirit in the horse. A true dray-horse could not last long in a waggon; as he is rather too heavy, as well as too slow.

It is stated, by the author of Modern Husbandry, that both Palladius and Varro direct that a mare should not be allowed to take the horse before she be two years old, nor after she is ten; because, when past that age, a weak and unprofitable breed may be expected. Palladius also advises, he says, that the stallion should be pampered and kept high with food; and adds, that if he be not allowed to cover till he have completed his fourth year, he will last very well till his twentieth. The practice of the horse-breeding farmers in this kingdom is, says he, nearly agreeable to the rules laid down by these writers; the only material difference being, that the mares are not suffered to take the horse till they be three or four years old; but continue to breed to a greater age than that above mentioned.

The usual season when a mare takes the horse is from the beginning of April to the beginning of July. The month of June is considered the best season in this country; although from the middle to the end of May is more approved of on the Continent, particularly in Normandy, where the farmers devote much of their attention to this branch of husbandry; and in which, especially in regard to useful farm-horses, they have succeeded, perhaps, beyond those in any other part of Europe. This difference, as to the time when a mare should be allowed to take the horse, in the different countries, is easily reconcileable:—a mare goes eleven months and a few days with foal; and the great object with all farmers, where practicable, is to have her covered at such a period as to ensure abundance of grass, and the return of warm comfortable weather, at the period of foaling.

An early colt is always to be preferred to one that falls late in the season.

In some districts, it is usual to give over working a mare some few weeks before the time at which it is expected she is to drop her foal. It is, however, by no means a common practice. In Yorkshire, and in those midland counties where the breeding and rearing of horses is better understood than in any other part of the island, they are often worked till the very time of foaling. Great care, however, is necessary in working and managing a mare heavy with foal: an over-heat, too severe exercise, a fright, or a sudden and violent jerk, are very apt to cause an untimely birth, whereby the foal is lost, and the life of the mare very much endangered.

It is generally understood, and is an opinion that is believed to be well founded, that a mare may be covered on the ninth day after she has foaled, with a

greater degree of success than at any other period. This practice is, of course, often followed; but in such cases the mare ought, Mr. Donaldson thinks, to be fed in an extraordinary manner, otherwise it is impossible she can do justice to her present and her future foal. But modern farmers would probably, he says, come nearer their purpose, were they to follow the example of the Romans, and content themselves with one foal in the two years. In England, and in the improved parts of Scotland, a mare after having foaled is turned, together with the foal, into a pasture field, and is allowed two or three weeks' rest, before she is again worked, either in plough or cart; the foal being allowed to suckle at pleasure during the time. After having had a few day's rest, she is again worked in the usual manner; the foal being commonly shut up in a house during the hours of working. In Yorkshire, some farmers are particularly careful not to allow the mare to go near the foal, after her return from labour, till her udder has been bathed with cold water, and not till most of the milk is drawn from it. These precautions are used with a view of preventing any bad consequences from the foal's receiving over-heated milk. Another practice, and which seems superior to the above, is also common in Yorkshire, and in many parts of Scotland:—after the foal is a few weeks old, and has acquired strength and agility enough to follow its mother, it is allowed to attend her in the field, during the hours of labour, and to suckle occasionally. By this means, the foal receives sufficient exercise; nor can any prejudicial effect happen from the over-heated state of the milk, as the foal is allowed to draw it off repeatedly, and at short intervals. These may be considered as the general modes of management in those parts of the kingdom mentioned above, during the period while the foal is allowed to suckle its dam, which is usually about six months; that is, from the time of foaling till Michaelmas, which is the period at which foals are generally weaned, or prevented from sucking.

At this time care should be taken, Mr. Bannister says, to keep the mare and foal from the hearing of each other, that neither the mare may bewail the loss of her colt, nor the latter fret and pine after its mother. The best method will be to confine the foal in a small stable by itself, which should be furnished with a rack and manger, where it may be fed with clean shaken hay and clean sifted oats, bruised a little in a mill. With this management he will quickly forget his dam, and become gentle and familiarised to his keeper, and in fair weather may be suffered to exercise himself in a pasture adjoining to the stable; but this should be only for a little while in the middle part of a sunny day, the tenderness of the young animal rendering it dangerous to keep him out in the night.

But in the mountains of Wales, and in the Highlands of Scotland, the management is, according to Mr. Donaldson, very different. There the breeding mares are never worked during the summer. They are driven to the hills and mountains at the close of the barley-seed season, where they remain till the inclemency of the weather forces them to return for shelter. But their scanty subsistence, the labour they are subjected to in procuring their food, and the moistness and coldness of the climate in the latter part of the season, render both themselves and their progeny of but little value or importance.

The method of treating foals in England, after they are weaned, is to put them immediately into a good fresh pasture, where they remain as long as the winter continues moderate. On the approach of winter they are fed with a sufficient quantity of hay, placed in a stable or hovel, erected in the field for the purpose, and into which they have free access at all times. The next summer they are put into other pastures, commonly the ~~most~~ indifferent on the farm, where they remain till the beginning of the following winter, when they are either allowed to range in the pasture-fields, or brought home to the straw-yard. The inclemency of the winter in Scotland, and the great falls of snow which generally take place, render it necessary always to house the foals there during that season. They are fed, for the most part, on straw, and have an allowance of corn once or twice a-day. Sometimes hay is allowed them, in which case corn is considered as less necessary.

The author of the New Farmer's Calendar advises foals to be fed all winter with a little corn twice a day, or carrots, with hay, oat-straw, &c. allowing a well-littered shed, or warm straw-yard. Colts fed at home with green meat, cut during summer, should have a daily range on a common, or elsewhere, for exercise. Yearlings to be carefully kept separate from the milch mares.

Cart-colts are often taken into hand at two years old; and it ought ever to be made a point to teach them to back, and to go in the shafts. Saddle-colts may be broke at three years old, or the autumn preceding; and it is of the utmost consequence to give them a good mouth, although some persons affect to slight it. Teach them to canter handsomely; and, if of sufficient size, they may be put to plough, the labour not being hard. Being quiet in harness, and good canterers, may greatly add to their value as well as utility.

The time for gelding colts is usually the same in both parts of the kingdom, which is when they are about a year old; although, in Yorkshire, this operation is frequently suspended till the spring of the second year, especially when it is intended to keep them on hand, and without employing them in labour till the following season.

It is added, that young horses are sometimes trained to work at two, but more frequently not till three, years old. The first thing is to teach them docility, by leading them frequently to and from the watering-place. The work in which young horses are usually employed is harrowing: to which they are inured by degrees, not being kept to labour above one half the day for the first few weeks, and afterwards worked only very gently for the remainder of the season.

It is a common practice for the breeders of horses to dispose of the young stock, at two or three years old to farmers in the southern districts; who, after keeping and working them for a like period, dispose of them to dealers from London and other large cities. This kind of traffic is very common, and is equally convenient and advantageous for all the parties concerned. The breeder, by meeting a ready and constant market for his young colts at the periods when he wishes to dispose of them, is enabled to continue breeding a regular number without the risk of being overstocked. The farmers, who are the first purchasers, may dispose of their stock of horses to the London dealers when proper opportunities offer, as they are certain that a supply of young horses will arrive in sufficient time for answering their purpose. The London dealer, again, in place of travelling to the northern districts of England, where the greatest number of young horses are reared, can supply himself with such as are more suitable for his purpose in the counties in his near neighbourhood. Besides the parties more immediately interested in this trade, there are generally no less than two agents, who make a living by carrying it on. The first is the *jockey*, or *jobber*, who purchases the colts from the breeder, and disposes of them to the south-country farmer. The second is the dealer in the neighbourhood of London, who either makes the purchase from the south-country farmer on his own account, and stands the chance of a sale in London, or who purchases on commission, for the dealers in the metropolis. This is the case also in Scotland.

The methods practised by the jockies in the north riding of Yorkshire is thus described by the writer of the Report of the State of Agriculture in that district:—"They (the young horses) are usually sold with their full tails to dealers, who afterwards make them up more according to art. The first business is to draw their corner teeth, in order to make three or four years old horses have the mouths of those of five. They also undergo the operation of docking and nicking; and after having been kept two or three months on mashes, made of bran, ground oats, or boiled corn, they are sold to the London dealers, who, it is said, sell these three or four years old horses as if they were five years old. They are then taken into immediate work, either for the coach or saddle; and in a few months are completely destroyed by this premature and too severe labour." He further adds:—"The drawing of the teeth is not a fraud practised on the London dealers; they *know* the deception, and *insist* upon its being done by the country dealers. It is requisite to be done some months before the London dealers finally sell them for use, or the tooth which denotes a horse to be five years old would not be grown, consequently the deception could not have taken place."

Means are also said to be sometimes performed for an opposite purpose—which is, to make an old horse look younger than he really is. The method adopted to effect this *laudable* end is (when a horse becomes so old as to lose the usual mark in his corner teeth, by which his age till he be seven or eight is usually ascertained), to drill a hole, or burn out one with a hot iron, in the corner teeth, as similar in size and form to the natural cavity as possible, and in this way impose on the inexperienced. See *Age of Horses*.

It must be universally allowed, Mr. Donaldson says, that, wherever horses are employed in agriculture, it becomes the business of the farmer to adapt the size and strength of them to the business he has to perform. He has long been of opinion that many English farmers sacrifice too much to show. If the expense of keeping, the slow movement, and the additional risk from accidents or death, which attach to the keeping the large high-priced black cart-horses, be considered, those farmers, who prefer them to the compact, active, hardy sorts, whether the Cleveland, the Suffolk, or the Clydesdale, which are the three sorts in the island best calculated in every respect for the farmer's use, will find that their predilection for these large fine horses is attended with a very heavy extra expense. The value of a horse ought, he thinks, to be estimated by the farmer not so much according to the price at which he was purchased, or at which he might be sold, as according to the extent of work which he is capable of performing without being fatigued. If, for instance, a pair of Suffolk or Yorkshire horses will plough two acres a day during the seed-season, they are more valuable for labour than a pair of large heavy Lincolnshire horses that are hardly able to perform half the work; while the first cost, the expense of keeping, and risk of accidents, are considerably less. If this reasoning be just, it will, says he, occur to every reader, that the whole undersized tribe of horses, particularly those reared on the mountains of Wales, and in the remote highlands of Scotland, are of little value, either in an agricultural or commercial view. Were these unimprovable districts occupied in the rearing of black cattle and sheep, it would be infinitely more advantageous for those concerned. Lands devoted to the rearing of such useless animals as those small horses may, he thinks, be denominated wastes in reality.

And it is remarked, by the author of the Synopsis of Husbandry, that on the œconomy of the stable depends, in no small degree, the profit or loss of the husbandman; since, if the working cattle are disproportioned, either in number or size, to the exigencies of the farm; or, if properly adapted in these particulars, should turn out unhealthy, either from natural causes or an undue attention in the persons to whom the management of them is entrusted; or if they are over-worked, or, on the contrary, are not kept with a sufficient degree of strictness to their labour; if they are pampered too high, or have not a due allowance of food: in either of these cases the owner will find an evident diminution in his profits; and, if not timely redressed, a want of attention to these minutiæ, as they may at first sight appear, will increase by slow progressions, till the evil may at length terminate in the ruin of those who have been remiss in this part of their business.

The method of working and managing farm-horses in the Carse of Gowrie (a district in the northern

part of the island, where much agricultural labour is performed) is:—In the spring, when the seed-season commences, to increase the hours of labour, and give food superior in quality to that on which the working horses were maintained during winter. They are then generally fed on peas-straw, or on hay; and, besides at least half a peck of dry oats, or of oats with a mixture of peas or beans, which is given to each horse in equal portions, when they return from the field, morning and evening, a stated allowance of the refuse or dressings of the grain, after having been mixed with chaff, and either soaked in cold water or boiled, is also given every morning and afternoon before labour commences. Thus, during the height of the seed-season, the farm-horses in the above district are regularly fed four times a day with corn: and, in place of performing all the labour of the day at what in the southern parts of the island is called one journey, throughout the whole of the year, the farm-horses in the north go two journies from the middle of March till the end of September. This Mr. Donaldson thinks a much better method, as thereby the labour is divided, and the horses are allowed to rest for four or five hours during the heat of the day.

But in summer they are kept constantly in the stable, except during the hours of labour, and are allowed as much cut clover as they are able to eat. In autumn, during the hurry of the wheat-seed season, as well as when the corns are carrying home to the stack-yard, an allowance of corn is also given, and which is continued in considerable quantities as long as the weather continues favourable for ploughing. On the commencement of winter, and when labour begins to slacken, they are commonly fed on straw, the allowance of corn being limited to about half a peck a-day: on many farms, indeed, the allowance of corn is wholly withdrawn, and potatoes, properly cleaned, substituted in its stead. The farm-servants in this district, partly owing to the strict injunctions they receive from their masters, and partly from a laudable pride which they possess of having their horses look better than those of their neighbours, are very careful in cleaning the horses of which they have charge. On returning from the field they regularly make them (after allowing them time to drink) walk through a pond to wash off the dirt from their legs; and when put into the stable, and the harness taken off, they rub them pretty smartly with some clean straw; and afterwards, when in condition for currying and dressing, these operations are performed with a very considerable degree of attention. With such treatment, and when horses are not over-heated, they will undergo an immense degree of fatigue. At the same time, the more personal attendance a farmer bestows on his horses, the better they will thrive. And if he will always bear in mind the old proverb, that "the master's eye makes the horse fat," there is little reason to doubt but he will be able to conduct the various operations of husbandry with more ease, and at less expense, than if he were negligent in this important matter.

It is remarked by the writer of the New Farmer's Calendar, that it is advantageous to mix one-fourth of good straw with the green meat given to labouring horses, or, indeed, any cattle, in summer; their work being hard, hay would be preferable to straw. For hard meat, clover-hay cut into chaff, instead of straw, renders less corn necessary. A cart-horse, labouring hard, will require more than a peck of oats per day, with the addition of nearly one-fourth of well-dried beans. Lord Pembroke experienced a vast saving by breaking the corn for horses, a practice which Parkinson of Doncaster, he says, as strongly condemns upon experience also. There is certainly a possibility, he thinks, that horses, finding their meat ready broken, may swallow it greedily without taking the trouble of mastication; and the meat, not being pressed or divided into sufficiently minute parts to assimilate with the juices of the stomach, may pass unconcocted and crude, without imparting its due quantity of nourishment to the animal. He has, however, used ground corn for horses many years, never observing any ill effects, but always taking for granted the good ones usually attributed to the practice. Lord Dundonald has likewise found the practice of breaking the grain highly advantageous.

The first of the above writers also advises, that the heels, legs, bend of the knee, and hock, the twist under the flanks,—in short, all parts out of sight, of cart-horses, whilst standing in the house, should be kept perfectly free from dirt and scurf, and the skin supple: the parts more in sight will take care of themselves. In a deep country, it is much the better practice, notwithstanding the prejudice to the contrary, to trim their legs coach-horse fashion. The number kept being considerable, it will, he thinks, pay to employ an odd man, or horse-keeper, to a certain number of animals. Never suffer, adds he, a pretended knowing carter to *doctor* horses, or to give them specifics for making their coats fine. Nip all such mischiefs in the bud. Suffer not a parcel of silly fellows to strain the cart-horses to pieces at *dead pulls;* keep their vigour for useful purposes. Many very excellent horses neither will, nor have it in their power, from certain concealed natural defects, to draw dead pulls. This hint is given, he says, from long experience.

It is added, that the coarse garbage with which farm-horses are commonly stuffed, profitably or otherwise, is the real cause of the frequent occurrence among them of blindness, grease, and colic; more particularly the last, which, with care, might be prevented from happening so frequently. The remedy lies in physic, once or twice a-year; either the regular aloetic dose, or salts given in pails of warm water, or sulphur and cremor-tartar; one-third of the latter mixed in the corn. All horses kept in the stable become, more or less, internally loaded; and it is an error, he thinks, to suppose cart-horses are not equally benefited with others by purging physic. See *Team*.

He recommends also an attention to the late improved practice of shoeing, and not to suffer the

blacksmith to cut any thing excepting that which is loose and rotten from the sole, bars, and frog of your horse's foot: these are, says he, the defence nature has given to the feet, and labour will wear it down full fast. The foot, preserved strong and sound, will require less iron and smaller nails. It is a great advantage when a horse can go upon his frogs; that is to say, when he can bear them to touch the ground at every tread. See *Shoeing of Horses.*

In turning out horses to grass, in general some caution is necessary at first, in order to inure them to the change, by only letting them remain a little while at a time.

There are two reasons, says Mr. Marshall, in his Rural Economy of Yorkshire, why horses which are subject to violent exercise should not be exposed at grass in severe weather. It takes them off their dry meat: and horses which sweat much are in the nature of things more chilly, suffer more from pinching cold, and are more liable to be seized by acute disorders, than horses which have more moderate exercise, and whose frames are more relaxed. A horse, which has been inured to those transitions of heat and cold, will, no doubt, bear them better than one which has always been used to a warm stable; and which certainly ought not to be exposed to such dangerous treatment without the greatest precaution.

He is nevertheless of opinion, that letting a horse run out in winter keeps his legs cleaner and more supple than standing always in the stable. His mare was not fresher on her legs at four years old than she had been that winter. And if hunters could be turned out on leisure days, when the weather is tolerably fine, into a spacious place to hay and corn, without grass, he is of opinion it would be of great service to them. Horses which are unavoidably exposed to transitions from heat to cold, as hunters frequently are, in sauntering by the side of a cover after a hard run, ought indisputably to stand in a cool stable, and to be exposed to the open air on leisure days, so far as the state of perfect health and vigour will permit, but no further.

He met with an idea in this district, respecting the first turning out of a horse entirely to grass, which, he says, deserves to be generally known. When a horse is thrown up, or turned out at nights to grass in the spring of the year, it is common to choose the forenoon of a fine day to do it in. The natural consequence is, the horse fills his belly during the sun-shine, and lays him down to rest in the cold of the night; thereby probably exposing himself to disorders.

A much better practice prevails here. The horse, instead of being turned out in the morning, is turned out at bed-time. The consequence is, he eats all night, and sleeps in the sun-shine of the next day. It is generally understood here, that horses at grass do not require water. They are frequently kept for months together in dry upland pastures without water, and without any apparent inconveniency. Water may, however, in many cases be necessary.

It is observed by Mr. Parkinson, that Irish horses are remarkable hardy; and, though many of them look mean, they are strong, and will do a great deal of work without very high keep; indeed, much more in proportion than he in general found the horses in England would do. Such as he has been accustomed to use in England are more powerful, and will do a great deal of work; but they must have high keep. He found no difficulty in ploughing land with a pair of common Irish horses. The method of feeding and managing horses as a team will be considered under that head. See *Team.*

Horse-*Balls*, in *farriery*, round masses of different remedies of the consistence of dough, which are passed down the gullet into the stomach of a horse for the cure of different diseases. These balls should be formed into an oval shape when they are given, and not exceed the size of a pullet's egg; and where the dose is large, they may be made into two. They should be dipped in oil, that they may slip down with the more ease; for much striving in thrusting down balls greatly increases the horse's antipathy to such things, and renders it troublesome to give remedies to him. There are some persons who, by frequent use, Gibson says, grow so dexterous in giving balls, that they seldom miscarry, and this without fatiguing the horse. These persons are such as generally begin young, while their hands are small, and bring that operation into an easy habit. But some horses have been so much tired with awkward unhandy persons, that they come to resist every thing that is offered to them in that manner; others are so untractable, and so shy of being handled about the mouth, that there is scarce any possibility of giving them balls without an instrument of iron to hold their mouths open; and therefore this should always be part of the stable furniture, where any number of horses are kept. Stables should also be provided with a *drenching-horn;* it being necessary to have these instruments always in readiness in case of accidents. The best drench-horns are those that are small and narrow in the mouth, and shaped like a spoon, wide in the belly, and sufficient to contain half a pint, more being unnecessary for one quantity; for too large draughts are apt to strangle horses, and put them into violent fits of coughing, especially when they are short-breathed, and oppressed with violent colds, or other similar disorders. See *Ball.*

Horse-*Bramble*, provincially the briar or wild rose.

Horse-*Hoe*, that kind of hoe which is wrought by the horse. See *Hoe.*

Horse-*Hoeing*, the operation of cultivating or stirring the ground between the rows of corn, or other plants, by means of the horse-hoe. See *Hoeing.*

Horse-*Keeper*, the name by which the person is called who keeps or looks after labouring or other horses. It is of great importance to the farmer to have a steady regular horse-keeper, as much saving may be made in this way without the condition of the animals being injured. See *Team* and *Groom.*

It is advised by Mr. J. Lawrence, that for saddle

horses "the ordinary regular stable-attendance is four times per day; early in the morning, twelve at noon, afternoon, and night. All saddle-horses kept in condition stand clothed in a kersey sheet, and girted with a broad roller, with occasionally the addition of a quarter-piece; the breast-plate is sometimes put on when going out to exercise; the hood is used to race-horses only, except in case of sickness. All horses, excepting racers, are best without clothing in the summer season."

And in respect to the method of dressing a horse, the present practice is mostly this: "Having tied up the horse's head, take a curry-comb, and curry him all over his body, to raise the dust, beginning first at his neck, holding the left cheek of the head-stall in your left hand, and curry him from the setting on of his head, all along his neck, to his shoulder, and so go all over his body to the buttocks, down to his cambrell-hough; then change your hands, and curry him before on his breast, and laying your right arm over his back, join your right-side to his left, and curry him all under his belly, near his fore bowels, and so all over very well, from the knees and cambrell-houghs upwards: after that, go to the far side, and do in like manner. Then take a dead horse's tail, or a dusting-cloth of cotton, and strike that dust away which the curry-comb has raised. Then take a round brush, made of bristles, and dress him all over, both head, body, and legs, to the very fetlocks, always cleansing the brush from that dust which it gathers, by rubbing it upon the curry-comb."

And "after that, take a hair-cloth, and rub him again all over very hard, both to take away the loose hairs, and to help to lay his coat; then wash your hands in fair water, and rub him all over with wet hands, as well head as body; for that will cleanse away all those hairs and dust the hair-cloth left. Lastly, take a clean cloth, and rub him all over till he be very dry, for that will make his coat smooth and clean. Then take another hair-cloth (for you should have two, one for his body and another for his legs), and rub all his legs exceedingly well, from the knees and cambrell-houghs downwards to his very hoof, picking and dressing them very carfully about the fetlocks from gravel and dust, which will lie in the bending of his joints."

It is justly supposed, that, "without regular grooming, it is in vain to expect that a horse will exhibit himself in his most beautiful colours, or be capable of his utmost exertions; in a word, that he will be in *high condition.*"

It is likewise properly advised, that "care should be taken by the master, that the curry-comb be not too sharp, or, at least, not used in a rude and severe manner, so as to be an object of torture and dread, instead of delight and gratification to the horse. It is too often the fate of thin-skinned horses to suffer much from the brutality of heavy-handed and ignorant fellows, who punish with hard blows every motion the irritated animal is necessitated to make, looking upon him as a mere machine, which is destined to undergo all kinds of inflictions, and thinking it an act of bravery, and a kind of point of honour, to exact absolute submission, possible or not, by the most prompt and rigorous punishment. But these are either persons entirely ignorant of horses, or ordinary stable fellows: a good groom acquires patience and circumspection from their necessity, which experience has taught him; he handles his stable-tools with a tenderness, dexterity, and adroitness, which nothing but the best lessons and much practice will teach; his horses are perfectly clean in every part, fed with regularity and cleanliness; he knows to exercise them with temperance and safety, and has a skilful hand to preserve them from a fall. A raw lad, or half-groom, will make a horse's back shine, and suffer the dirt to remain in all the hidden parts; will either gorge him with meat, or repeatedly neglect him; and, whenever he takes him out to exercise, will be sure to do him more harm, by worrying him about (which he probably thinks a gallant thing), than a day's journey would do, and, if possible, break his knees before he returns. A gentleman, himself inexperienced in horses, but wishing to keep them in good style, must have a groom who has served in stables of repute; or, if he desire to make a groom, he must send his servant where he can see good practice, or he will but deceive himself."

It is added, that "the care of the *legs* and *feet* forms a most important branch of stable discipline. The legs must be kept perfectly dry, and so clean that not a speck of dirt be suffered to lodge in any crevice under the knee or fetlook, or around the coronet, and withal preserved cool and free from stiffness and inflammation. Dirt suffered to form a lodgment, or wet remaining upon the legs in cold weather, will fret the skin, and cause cracked heels, *mallenders* and *sallenders*, *rats-tails*, *crown-scab*, and such a train of stable plagues, as may baffle the most vigorous efforts during a whole winter. From want of care, the best flat-legged horses, whatever may be their condition, will soon become greased; but he has seen round fleshy-legged cattle, which could never be preserved from it by the utmost care of the most expert grooms, and which absolutely could not be kept in the house at all with whole legs." And much care "should likewise be taken not to irritate and add to the inflammation of the legs, by harsh, too long continued, or improper rubbing; and if they be tightly bandaged with linen or woollen, which every groom knows how to perform neatly, it will contribute to cleanliness and the general end. Some gallopers are apt to crack the skin of their heels in exercise: in that case he advises to supple the skin occasionally with simple ointment, though, in general, warm-water will be a sufficient preservative. Pains and soreness in the shins and shank-bones are often the consequence of exercise over hard ground in very dry seasons, for which there is no better palliative than frequent warm emollient fomentations," or some similar means.

It is added, that it forms a part of the constant attention of a good horse-keeper, to see that "the *feet* of his horses be well cleansed beneath the shoe with the picker from all small stones or

gravel, at every return from abroad. The shoes must be examined, that their ends do not press into the crust, and that the nails be fast; otherwise instant application must be made to the farrier. Horses ought by no means to remain in old shoes until the toe is worn away, or the webs become so thin that there is danger of their breaking, unless in case of brittle hoofs, when it is an object to shoe as seldom as possible. Upon the average, good shoes will wear near a month. Steeling the toes is, in general, an useful practice, but less necessary when the best iron is made use of." The use of the artificial frog is also material in some cases. See *Frog*.

As all sorts of oils and greasy applications are found to harden the hoofs, they should be banished from the use of the stable. But as "some hoofs, however, require to be hardened, the use of oil, as a *remedy* at least, may be advisable. Mr. Lawrence objects also to the practice of stopping the feet of horses with dung, and various other compositions, which are also reprobated by other writers." Such "feet as have been rendered as hard as oak, and nearly foundered, or by the heat and greasing discipline of the livery-stables, have very shortly been put into a state of gradual amendment, by well soaking their hoofs three times a-day with warm-water, in the above writer's practice. For the naturally soft hoof, he knows of no other remedy than cold spring-water, or chamber-lye, and perhaps an occasional stopping with blue-clay, having never found permanent benefit from the use of any restringent medicaments."

It is considered as "beneficial, in general, to take off the shoes of a horse which is necessitated to stand long in the stable, and which does no work; the growth of the crust and the enlargement of the heels being thereby promoted."

It is another part of the duty of a horse-keeper to take care of the furniture and trappings. These are best kept in order by being instantly rubbed clean after use, and placed in a dry situation: by which method, neither oil nor scouring-paper is often found necessary. Great care should be taken to dry the pads of the saddles after journies, and never to put a hardened and damp saddle upon the horse's back. The same is also necessary with regard to the body-clothes. The pads of the saddles ought to be kept perfectly soft, and free of dirt and sweat; and, after use, should be dried either in the sun or by the fire, and hung in a dry place: the clothes also should be washed much oftener than they generally are, and ever kept perfectly dry, and in a sweet state.

It is further stated, that "the ordinary periods of feeding horses with corn, in this country, are morning, noon, and night; the quantities each time either a quarter or half a peck, with or without about two handfuls of beans, according to the horse's state of body." And that much "greater care than is common ought to be had to sifting the oats clean from dust, and the dung of mice. Water should be allowed without fail twice a-day. The writer has often heard of the hay and water system of certain economical stables, calculated to furnish the horse with a carcase, and save the expense of corn; but there is also an error not unfrequent among stable people, who suppose water to be at best but a kind of necessary evil to horses, and therefore think it a point gained, whenever they can find an opportunity to abridge the quantity. They find warrant for this practice in some of the old authors; but how well soever a horse may shift with little or no water whilst abroad and feeding upon succulent meat, it is indispensible to him in the stable, and ofttimes much mischief ensues from its being withheld."

It is probably an improper custom to ride horses briskly after watering. The practice of the above writer has been to walk them briskly after water; or, in bad weather, and stable-watering, to rub them well over the breast, belly, and loins.

These directions are likewise in some measure applicable to farm-horses, though it is not necessary that they should be so very minutely followed. In regard to the proper feeding of this sort of horses, it will be considered more fully under its proper head. See *Team*.

Horse-*Knobs*, a name sometimes applied to knob-weed or knap-weed.

Horse-*Measure*, in *rural economy*, a rod of box, made to slide out of a cane, with a square at the end, being divided into hands and inches, to measure the height of a horse or other animal.

Horse-*Rake*, a large sort of rake drawn by a horse, and much used in many of the southern districts. See *Rake*.

Horse-*Shoe*, in *farriery*, a cover or defence for the sole of the horse's foot. See *Shoe*, *Shoeing*, and *Foot*.

Horse-*Stealing*, the practice of stealing these animals, which, notwithstanding the very severe penalties in case of detection, is still much continued. The best security against it is, according to Mr. Lawrence, that of locking, "upon the shank or pastern of the animal, a case-hardened and file-proof iron ring, lined with some soft material to prevent chafing, and bearing the owner's name and place of abode; but some have preferred the fixing a collar upon the neck, which is rather more expensive, and, perhaps, less secure from the file: but, in either case, the price would not be any great object. It is granted there would be no absolute security in this plan, since thieves get their bread by their ingenuity; but it would certainly place a very formidable difficulty in the way of the exercise of their calling. There are few thieves, he thinks, but who, on inspection, would prefer a horse without this troublesome mark upon him. Granting a man did his business at random, and blundered upon a horse in the dark bearing the aforesaid mark, as soon as the light should enable him to discover it, he would, no doubt, run away from his new and dangerous bargain as fast as he would from a thief-taker. Suppose even a man went prepared with tools proper to destroy the iron, he must have an assistant, and the operation would demand some time, which would risk a discovery. In case of strays, the security is complete. But, in all cases, it seems, the present trouble is sup-

posed to outweigh the eventual benefit of precaution: that he leaves to the calculation of those who are interested." This mode certainly deserves the attention of those who have valuable horses.

HORSE-*Tree*, a term signifying the whippin, swingle-tree, or whipple-tree.

HORSEMANSHIP, in *rural economy*, the art of riding safely and gracefully on horseback. It also signifies, in some degree, the economy and management of horses.

The following directions for riding are laid down by Mr. Lawrence: "The modern seat on horseback, and it seems to have owed its establishment to reason confirmed by experience, is, he says, to sit naturally and easily upright upon your saddle, as you would in your chair; your knees about as much bent, and turned inward, your toes somewhat out and upward, your leg falling nearly straight, and your foot home in the stirrup; your back-bone prepared to bend in the middle upon occasion, your elbows held close to your sides, your hands rather above the horse's withers, or the pommel of the saddle, and your view directed between his ears. This, says he, is the true turf or Newmarket seat."

It is added, that "the decline of riding-house forms in this country, and the universal preference given to expedition, fully confirm the superior use and propriety of a jockey-seat. Indeed, our riding-schools are now, the writer says, considerably reformed from the stiffness of ancient practice in all respects. But the reader, on a reference to Hughes's publication, will find we do not entirely agree in all points. It was the practice, he says, formerly in the schools, and indeed pretty generally upon the road, to ride with the tip of the toe only in the stirrup; as if it were of more consequence to prepare for falling with safety, than to endeavour to sit securely. Those who preserve a partiality for this venerable custom, we would advise to suspend a final judgment, until they have made a few more essays upon a huge cock-tail half-bred, of that kind which 'cannot go, and yet won't stand still,' and will dart from one side of the road to the other, as if he really desired to get rid of his burden. Nor is the ball of the foot a proper rest; chiefly because inconvenient to that erect, or rather almost kneeling, posture, which is required in speedy riding. The riding-house seat is, he says, preserved by the balance or equipoise of the body solely; that recommended here by the firm hold of the knee, which is obviously strengthened by the opposite directions of the knee and toe, the one in, the other outward. The use of a fixed seat is to enable the rider to give his horse the proper pulls, without which every experienced jockey knows he can neither go steadily and well, nor last his time. It is not the custom of the schools to spur the horse with a kick, but spurring is always so performed upon the road and field; as the military mode of giving that correction would quite derange a jockey-seat, and would be on other accounts inconvenient."

The same writer further remarks, that "there are many persons, unaccustomed to riding on horseback, who, when they occasionally mount, are very justly anxious both for their personal safety and their appearance. It is for the benefit of these he writes. If they will immediately adopt proper rules, they will not only make a respectable horseman-like appearance, but will place themselves in the line of improvement, and in a situation the best calculated to insure their safety. Instead of being able to keep their spurs from the horse's sides, they would, with a proper seat, experience considerable difficulty in reaching them. It is too often neglected, even by people who are fond of horses, to teach their children a good seat, thinking it probably quite sufficient if they can but stick fast; and some young gentlemen are to be seen, riding with their fathers, he observes, in a very vulgar and unbecoming style."

It is further noticed, that he "cannot speak to the antiquity of the English fashion of rising in the stirrups during a trot, and of preserving time with the motions of the body, in unison with those of the horse; but the knowledge of it is discoverable in Bartlet, and in no author before him. It would be superfluous to give directions on this practice, which will be instantly acquired by observation and use. The same may be said of the gallop, which is performed, on the rider's part, like some other pleasant actions, kneeling; the pulling of the horse helping to keep the rider steady. In the canter, the rider sits upon his seat as in an easy chair. The method of giving the wriggling helps with the bridle, either in the gallop or swift trot, to encourage a horse forward, must be acquired by practice."

The following are some of the useful directions given by Mr. Hughes, in his work on horsemanship. "If you would mount with ease and safety, stand rather before the stirrup than behind it; then, with the left hand, take the bridle short, and the mane together, help yourself into the stirrup with your right, so that, in mounting, your toe do not touch the horse. Your foot being in the stirrup, raise yourself till you face the side of the horse, and look directly across the saddle; then, with your right hand, lay hold of the hinder part of the saddle, and, with your left, lift yourself into it.

"On getting off the horse's back, hold the bridle and mane in the same manner as when you mounted, hold the pommel of the saddle with your right-hand; to raise yourself, bring your right leg over the horse's back, let your right-hand hold the hind part of the saddle, and stand a moment on your stirrup, just as when you mounted. But beware that, in dismounting, you bend not your right knee, lest the horse should be touched by the spur. Grasp the reins with your hand, putting your little finger between them. Your hand must be perpendicular, your thumb uppermost upon the bridle.

"Suffer him not to finger the reins (the groom, in holding the horse), but only to meddle with that part of the head-stall which comes down the horse's cheek: to hold a horse by the curb, when he is to stand still, is very wrong, because it puts him to needless pain.

"When you are troubled with a horse that is vicious, which stops short, or, by rising or kicking, endeavours to throw you off, you must not bend your body forward, as is commonly practised in such cases; because that motion throws the breech backward, and moves you from your fork or twist, and casts you out of your seat: but the right way to keep your seat, or to recover it when lost, is, to advance the lower part of your body, and to bend back your shoulders and upper part. In flying or standing leaps, a horseman's best security is the bending back of the body.

"The rising of the horse does not affect the rider's seat; he is chiefly to guard against the lash of the animal's hind-legs, which is best done by inclining the body backward. Observe farther, that your legs and thighs are not to be stiffened, and, as it were, braced up; but your loins should be lax and pliable, like the coachman's on his box. By sitting thus loosely, every rough motion of the horse will be eluded; but the usual method of fixing the knees only serves, in great shocks, to assist the violence of the fall. To save yourself from being hurt, in this case, you must yield a little to the horse's motion; by which means you will recover your seat, when an unskilful horseman would be dismounted.

"Take, likewise, particular care not to stretch out your legs before you; because, in so doing, you are pushed on the back of the saddle: nor must you gather up your knees, as if riding upon a pack, for then your thighs are thrown upwards. Let your legs hang perpendicular, and sit not on the thickest part of your thighs; but let them bear inward, that your knees and toes may incline inwards likewise. If you find your thighs are thrown upwards, open your knees, whereby your fork will come lower on the horse. Let the hollow or inner part of the thighs grasp the saddle, yet so as to keep your body in a right poise. Let your heels hang straight down; for while your heels are in this position, there is no danger of falling."

The following is suggested as an excellent rule:—"If your horse grows unruly, take the reins separately, one in each hand, put your arms forward, and hold him short, but pull him not hard with your arms low; for, by lowering his head, he has the more liberty to throw out his heels: but if you raise his head as high as you can, this will prevent him from rising before or behind; nor, while his head is in this position, can he make either of these motions.

"Is it not reasonable to imagine, that, if a horse is forced towards a carriage which he has started at, he will think he is obliged to attack or run against it? Can it be imagined that the rider's spurring him on, with his face directly to it, he should understand as a sign to pass it? These rational queries are submitted to the serious consideration of such as are fond of always obliging their horses to touch those objects at which they are or affect to be frightened."

It is advised by Mr. Lawrence, that "indifferent horsemen should never venture on horseback without spurs. Those who reflect upon the predicament of being placed between a deep ditch and a carriage, at which their horse shies, will see the necessity of this precaution." And there is, he says, "a circumspection to be adopted advantageously by the unskilful, which will, at first, give them the semblance, and afterwards the reality, of good riding. The method of taking a rein in each hand occasionally (much in use of late years) gives the rider great command over the mouth, neck, and fore-quarters, of a horse. But a good horseman, without pressing too much upon the mouth of his horse, is always prepared to assist him, in case of a blunder, with the united exertions of his arm, chest, shoulders, and loins; and, from the force of constant habit, this comes instinctively, as it were, for the occasion, even if the accident be unnoticed, or the mind otherwise engaged. Both hands upon the bridle are necessary and becoming, in riding fast down steep descents or stony ways; and it is extreme folly to commit the reins to the neck even of the safest horse."

It is further noticed, that "previous to mounting, every person will find his account in examining the state of both horse and furniture with his own eyes and hands; for, however good and careful his groom may generally be, it is a maxim, that too much ought not to be expected from the head of him who labours with his hands. Besides, all such sedulously avoid trouble, particularly in nice matters. For example, see that your curb is right, that your reins are not twisted, that your girths, one over the other, still bear exactly alike; that the pad be not wrinkled up; but, above all, that your saddle lies exactly level upon the horse's back. Further and more full directions may be met with in the writers noticed above. The modes of breaking, riding, and managing such horses as are employed in labour, are given under the articles *Horse*, *Team*, &c.

HOSE, a term signifying the vagina or sheath of corn.

HOT-BED, a bed of earth, under which manure in a raw state has been placed, in order to generate heat, and in that way forward vegetation where the season or climate is not warm enough for the purpose.

This mode of cultivation cannot be had recourse to in husbandry, except in particular kinds of crops, such as those of potatoes, in which the sets are usually put in upon the littery dung in the drills, and thus a sort of hot-bed formed for them to grow in and extend their knobby roots.

HOT-BED *Culture*, that sort of cultivation that approaches to the nature of the hot-bed method.

HOTCH, provincially a bad job or business.

HOUGH, the ply or bending of the hind leg of an animal, and likewise comprehends the point behind, and opposite to the ply, called the *hock*.

The hough of a horse should be full, and not too much bended.

HOUGH *of a Horse*, in *farriery*, is the ply or bending part of the hind-leg, comprehending also the point behind and opposite, called the *hock*. The hams of a horse should be large, full, and not

too much bent, nor over-charged with flesh, nervous, supple, and dry; otherwise they will be subject to many imperfections and faults.

HOUND, in *rural economy*, a species of dog used in hunting.

HOUSE-*Bote*, a feudal term signifying an allowance of timber out of the lord's woods for the repairs of a house.

House-*Lamb*. See *Lamb-Suckling*.

HOUSING, a term signifying the running together of the hop-binds at the top of the poles. It also signifies putting animals under cover.

HOVE, a term signifying to swell or rise as cheese.

HOVEL, a sort of shed that is open on the sides, but covered over-head.

HOVEN, in *farriery*, a disease in cattle and some other animals, arising from distension of the stomach, caused by the extrication of air from the eating of too much green succulent food; such as clover, rank grass, &c.

The remedy in this disease is obviously the removal of the confined air. In slight cases of this kind the disease may frequently be removed by the use of such remedies as have a tendency to arrest the progress of fermentation, or dispel the *flatus* from the stomach. In these views much advantage may be derived from prepared ammonia in large doses, and dissolved in some spirituous liquor.

It is observed, in a paper in the twenty-ninth volume of the Annals of Agriculture, that Dr. Monro, professor of anatomy at Edinburgh, attributes the swelling of the belly to the distension of the stomachs, and particularly the first stomach, by the fixed air, which is disengaged from the tender and succulent grass, &c. in consequence of its solution and violent fermentation; while the discharge of it afterwards, through the gullet, seems to be prevented by a spasm, or muscular contraction of the upper orifice of the stomach: and he remarks, that the dangerous and often fatal effects which follow the distension are not owing to the fixed air, or the juices of the fermented grass, acting as poisons upon the stomach, as a moderate quantity of either produces no bad effects; and that the repeated experience of the grazier has shown, that many cattle are immediately relieved and preserved by stabbing them with a knife, and thus allowing the air to escape. He consequently concludes that cattle may with certainty be saved, if the air be drawn off in due time, without injuring the stomach or other bowels; and he affirms that this may be done with great ease, by passing a flexible tube from the mouth down the gullet into the stomach. The tube he recommends is to be composed of iron wire, of about one-sixteenth of an inch diameter, twisted round a smooth iron rod three-eighths of an inch diameter, in order to give it the cylindrical form; and, after taking it off the rod, it is to be covered with smooth leather. To the end of the tube, which is intended to be passed into the stomach, a brass pipe, two inches long, of the same size, or something larger than the tube, and pierced with a number of large holes, is to be firmly connected. To prevent the tube from bending too much within the mouth or gullet, in the time of passing it down into the stomach, an iron wire, one-eighth of an inch diameter, and of the same length as the tube, is put within it, which is to be withdrawn when the tube has entered the stomach. He has found that the space from the fore-teeth to the bottom of the first stomach of a large ox measures about six feet; and he has passed such a tube, five feet nine inches long, into the gullet of a living ox. The tube ought therefore to be six feet long, that we may be sure of its answering in the largest oxen.

It is added, that, after the tube is passed into the stomach, it may be allowed to remain for any length of time, as it does not interrupt the breathing of the animal. The greater part of the elastic and condensed air will be readily discharged through the tube; and, if it be thought necessary, ardent spirits, or any other fluid fit for checking fermentation, or which may be useful in other respects, may be injected through the tube into the stomach. By means of such a tube, the air is not only more certainly discharged than by stabbing the animal, but the danger is avoided which the stabbing occasions; not so much by the irritation which the wound creates, as that the air, and the other contents of the stomach, getting into the cavity of the belly, between the containing parts and the bowels, excite such a degree of inflammation as frequently proves fatal to the animal. This flexible tube has likewise been found of infinite service in saving the lives of sheep, when attacked by similar disorders, or any other swelling peculiar to that animal; and the instrument is so simple and easy to make, that he imagines any common workman may be equal to the undertaking. Tubes of this sort are made and sold by James Mac-Dougale, in London.

Another contrivance, equally useful and simple, has been invented by Mr. Eager, for relieving hoven cattle and sheep; for which he obtained a premium of fifty guineas from the Society for the Encouragemens of Arts, &c. in 1796.

At A A *fig.* 7, in *pl.* XLVI. is represented the knob of wood, and part of the cane to which it is attached, of a proper size for oxen, or other large cattle; the length of such cane should be six feet. And at *fig.* 8, B B is the knob of wood, and part of the cane calculated for sheep; its length ought to be three feet at least.

Mr. Eager directs, that when any beast is *swollen* or *hoven*, a person should lay hold of it by the nostril and one horn, while an assistant steadily holds the tongue with one hand, and with the other pushes the cane down the animal's throat. Attention must, however, be paid that the animal does not get the knob of the cane between his grinders, and that it be thrust to a sufficient depth; because the whole length will do no injury. As an obstacle will occur at the entrance of the paunch, the cane should be pushed with additional force; and as soon as a fœtid smell is observed to issue from that place, and the

body of the beast sinks, the cure is performed, as nature will effect the purpose afterwards. The utility of this practice has been fully established by experience with several large stock-farmers.

The common practice of making an incision with a pen-knife between the short ribs, introducing a quill, or small tube of ivory or smoothed elder, in order to give vent to the confined air, the wound being covered with adhesive plaister, to prevent it from being affected by the external cold, is mostly the result rather of absolute necessity, than of mature thought; and, though sanctioned by custom, it is often liable to be attended with fatal consequences, through the ignorance or inexpertness of the operator; it of course becomes necessary to have recourse to more easy remedies. But medicines are seldom of any particular service, on account of the distance from which they are to be procured. The following remedy advised by Mr. Young, in Vol. XXXIII. of the Annals of Agriculture, may, however, be useful, as being composed of simple, cheap, and common ingredients. Let three-quarters of a pint of olive oil, and one pint of melted butter or hog's-lard, be mixed together, and given the animal by means of a horn or bottle; if no favourable change be produced in a quarter of an hour, the same may be repeated. This dose is calculated for neat-cattle: for sheep, when *hoven* or *blown*, a wine-glass full and a half, or two glasses, will be sufficient, to be given in like manner. And it is asserted, that this remedy is a specific for the malady in question, effecting a cure within the short period of half an hour or less.

The best preventative is, probably, that of simply turning cattle into such pastures only when they are not pressed by hunger, so that their appetites may be soon gratified; or by gently driving them about for a few hours, that the dew may not only have time to evaporate, but also the animals, by being thus suffered to graze a very short time at once only, their stomachs may become gradually accustomed to the food, and they be less liable to injury.

The author of the Synopsis of Husbandry also remarks, that, when this accident occurs, every means should be taken to promote the evacuation of the *fæces*, by keeping the beast in continual motion; but if this method should prove ineffectual, and the creature should continue to swell and express its uneasiness in moans, and refuse to stir, the danger is imminent, and recourse must be had without delay to a manual operation, which is thus performed:—On the left side of the abdomen, midway between the short ribs and the hip-bone, a long knife should be thrust to the depth of four or five inches; this is called *paunching*, and, if properly executed, will occasion an instant expulsion of wind, which seldom fails to relieve the creature. The wound should be daubed over with tar, mixed with train-oil, to prevent any annoyance from insects, and defended from filth by a piece of cloth or other covering.

HOVER-*Ground*, a term provincially applied to light ground.

HOW, a term signifying a round hillock, or artificial small hill.

HUBS, a term signifying the naves of wheels.

HUCAMYBUFF, a term provincially applied to such lands as have been pastured, and which have much coarse tufts of grass, which are afterwards cut and made into hay: it is often termed *hobbing*. It is frequently pronounced *hogamybuff*.

HUDDER, a term applied to the sheaf by which the hattock is covered at the top, and protected from the wetness of the season.

HULL, the chaff, or husk, of corn.

HULVER, provincially the holly-tree.

HUMBLED, a term signifying hornless, in regard to cattle and sheep.

HUMOUR *in the Eye*. See *Eye*.

HUMOURS, in *farriery*, a term applied when a swelling happens on any part; in which case, the common language is, the humours are fallen there; hence endeavours are made to draw them away, or to repel them. Thus, by a jargon of words, the mind is led off both from attending to the proper means, and from the method of applying them to the greatest advantage. As a relaxation of the solids may be the cause of the complaint; by consequence, relief can be only had from restoring their former strength; and, according to other different causes, different remedies will be required. It is thus "often affirmed, that humours fall down on the limbs, when, with more propriety, it might be said, they cannot so well rise up or circulate so freely in perpendicular as in diagonal canals; for the force of the heart is the same, whether to raise a column of blood in an upright or horizontal direction, though it is not the same in respect to the situation of the vessels; for, when an animal is erect, the blood-vessels in the legs are more on a stretch by far than when he lies down; and, if the vessels are in a lax state naturally, or relaxed by external injuries, they are not able to propel the fluids forwards, and hence, from a retarded circulation, arises a swelling in the part affected. Dr. Bracken was the first writer on farriery who endeavoured to set this matter in a clear light; and who observes, if the reader would be at the pains to get a clear idea of the blood's circulation, with the secretions from it, and consider the solids as composed of elastic fibres, which are sometimes in a lax state, and at others in a tight or firm one, this knowledge would soon convince him, that the extreme parts may be swelled without humours falling down upon them, which arises from a difficulty in the circulation to push on the blood in perpendicular columns, or else from a laxity of the vessels themselves." The doctrine of humours is now much exploded by farriers.

HUNG-*Teap*, a term provincially applied to a small ram, in opposition to *close-teap*, or one whose testicles are not come properly down into the cod.

HUNGER, an animal appetite arising from an uneasy sensation at the stomach for food. When the stomach is empty, and the fibres possess their natural tensity, they draw up closely the folds of the villous coat, so as to cause that sensation; but, when they are distended with food, it is again removed. See *Appetite*.

HUNGER-*Rot*, in *farriery*, a disease in sheep. It is generally occasioned by poor stinted keeping, particularly during the winter season. It is readily distinguished by the appearance of the sheep, which is extremely lean, thin, and ragged. The best method of cure is, probably, that of a gradual change to better keep. *See Rot.*

HUNGRY *Evil*, in *farriery*, a vulgar term, denoting an inordinate desire in horses to eat. See *Appetite*.

HUNTER, in *horsemanship*, a name given to a horse qualified to carry a person in the chace. The shape of the horse designed for this service should be strong, and *well put together*, as the jockies express it. Irregular or unequal shapes in these creatures always denote weakness. The inequalities in shape which show a horse improper for the chace are, the having a large head and a small neck, a large leg and a small foot, and the like. The head of a hunter should indeed always be large, but the neck should also be thick and strong to support it. The head should be lean, the nostrils wide, and the windpipe straight. And, in order to his behaving well in the field, the horse ought to have great care and indulgence in the stable: he ought to have as much rest and quiet as may be, to be kept well supplied with good meat, clean litter, and fresh water by him: he should be often dressed, and suffered to sleep as much as he pleases. He should be so fed that his dung may be rather soft than hard, and likewise of a bright and clean colour. All this may be easily managed by the continual observance and change of his food, as occasion requires. After his usual scourings, he should have exercise, and mashes of sweet malt, or bread and beans; or wheat and beans mixed together may be his best food, and beans and oats his worst.

Great attention is necessary in the food, exercise, and management, of these horses at all times, but especially during the hunting season.

HURDLE, a light frame of wood, somewhat in the form of the common gate, constructed for the purpose of forming a moveable fence for the confining of sheep and other animals. They are generally made of some light split timber, or of hazel-rods, wattled together.

These are principally employed in cases where sheep are folded on arable lands, or where either these or cattle are fed with turnips in the field, to keep them upon a certain space of ground, or divide a certain portion of their food at a time, in which way they are extremely useful; as the sheep, by being so closely confined, contribute greatly to the improvement of the land in the first case; and either they or cattle, by having a given quantity of food allowed them at once, eat it clean up without any loss, which they would not do if allowed to range at large over the whole field.

There are, however, many other purposes to which hurdles may be applied with equal advantage. It is observed by Mr. Somerville, in the second volume of Communications to the Board of Agriculture, that in the grazing of a large field, for instance, when the sheep or cattle are turned upon it early in the spring, they tread down and destroy a great deal of the grass; and, by dropping their dung and urine upon the remainder, injure it so much as to render it unpalatable to the stock. In this way a great proportion of the grass is lost in every field of considerable extent: whereas, when the stock is first put upon the field, if hurdles or flakes were run across a small part of it, as is the case with turnips, and the grazing stock kept there till they had eaten the herbage clean up, they would then from necessity eat a great deal that is entirely lost when they are permitted to range over the whole field. In this way considerably more stock might, he thinks, be fed upon a given space than is done at present. It is to be observed, however, he says, the first space divided off by the flakes should be next the water, especially if the field is grazed by black cattle or horses, and that progressively; as the stock is removed from the watering-place, a lane should be left by which the cattle may travel to the pond. It is also to be noticed, that after the first space allowed to the grazing stock is eaten clean up, and as soon as they are shifted to a new place, a course of flakes should be placed behind them to prevent them from going backward upon the pasture that has already been eaten bare. By this management the whole of the herbage, upon every space allotted to the stock, will not only, he thinks, be completely eaten up, but, by dividing or fencing off that part which has been eaten, the plants are allowed to recover; and, long before the whole field is gone over, the space first eaten will be in a situation to receive the stock a second time. By this method, he supposes, the dung and urine of the stock, instead of rendering the herbage nauseous and unpalatable, and thereby preventing them from eating it, will, by its fertilising powers, assist its growth, and render it sooner fit for being eaten a second time, and by that means afford three or four crops in the space of a year instead of one. Experience has, he says, sufficiently evinced the great profit and advantage that attend the practice of teddering cattle or horses upon good pasture, or of feeding them in the house with cut grass. The benefit in both these cases arises from the whole of the herbage being completely eaten up, without any part of it being lost. The same benefit, but with infinitely less trouble, may, he conceives, be reaped from *hurdling* or *flaking* grass-fields: every possible advantage will be made of them in this way; and in very many instances it will happen, that, before a half or two-thirds of the field are gone over by flaking, the part first eaten will be in a situation again to receive the stock. By that means a part of the field may be saved for hay; or, if the views of the occupier are of another kind, the number of the grazing stock may be increased in a proper degree.

He is aware, however, that it may, and no doubt will, be argued by many, that this management will be attended with much trouble and expense; and, after all, that the profit resulting therefrom will be but small, and scarce prove equivalent to the trou-

ble and extra-expense. From the acknowledged value of hurdling, however, in the consumption of turnips, cabbages, &c. and the great profit which arises from giving the stock only a certain quantity of food at once, and withholding any more from them till that is eaten up, some idea may, he thinks, be formed of the vast advantage that would attend the flaking of a grass-stock in different cases. He by no means, however, wishes these observations to be understood as applying to grass-pastures of every description; quite the contrary; as there are many situations where the expense and trouble of flaking would prove more than an equivalent for any advantage that could be reaped from the practice. But, upon all rich pastures, the benefit arising from the practice of flaking will, he thinks, be found very considerable, and a single experiment will be sufficient to convince the most incredulous.

In parks, pleasure-grounds, and other ornamented lands, the eating of the grass may, however, be best effected by having recourse to the use of hurdles; as by such means the danger of injury to the trees or shrubs is fully guarded against; and, from the moveable nature of the hurdles, any part may be eaten at pleasure.

The framed hurdles are generally from about twelve to eighteen or twenty shillings a dozen, according to the goodness and kind of wood from which they are made: but the wattled kinds are seldom more than from ten to twelve shillings the dozen. A dozen and a half will fold thirty sheep, and twelve dozen 1000.

It is observed by Mr. Young, in his Survey of Lincolnshire, that vigilance in the lambing season prevents much of the danger in bad weather; and a provision against the loss of lambs in the ditches of the breeding pastures has there been made at a small expense by means of lamb-hurdles, constructed according to the representation given at *fig.* 11. *pl.* XLIII. And at *fig.* 12. is a common hurdle.

The space between the rails are to be closed with tarpaulin, whereby the hurdle, when the lower rail touches the ground, is a perfect defence against the wind, and of a sufficient height to prevent the lambs driving before a storm into the ditches: so that it answers two good purposes. At other seasons, also, these hurdles may come into use for guarding the brows of banks against sheep.

As the tarpaulin would require many nails, and canvas is a dear article, perhaps the space between the two rails may, he says, be better filled by a slit deal, held in its place by having braces, AA, on both sides, one of which might be moveable, and fix with nuts on the rivets; by which means the board might be put in only occasionally when wanted.

HURDS, the coarser parts of flax or hemp, separated in the dressings from the tear or fine stuff.

HURLE-BONE, the hip-bone in a horse or other animal. It is very apt to go out of its socket by a blow or strain.

HURPLE, a term signifying to stick up the back, as cattle in cold weather.

HURRY, a term applied to a small load of hay or corn.

HUSBANDRY, the art, business, or employment, of the farmer, or person who is engaged in the cultivation of land.

It is of various kinds, according to the objects of the agricultor, and the methods in which the farm is managed. Thus, in respect to tillage-lands, we have the broad-cast and drill husbandry, which by farmers is frequently further distinguished by the appellations of *old* and *new;* the former being that which has been supposed to have been practised from the most early times; and the latter that introduced and recommended by the ingenious Mr. Tull, and often farther distinguished into the horse-hoeing husbandry. It is probable, however, that this last method of husbandry is not so new as has been commonly believed; as it has been found, that among the eastern nations, where few or no agricultural changes have taken place for a vast length of time, this practice is prevalent for most sorts of crops.

The broad-cast husbandry is that sort of arable practice in which the seed is sown or dispersed over the ground by means of the hand, without any great attention being paid either to the regularity of the crop, or the culture of it afterwards. And it has also been supposed by some, that less preparation of the land was necessary in this way, though late experience has clearly shown the contrary to be the case.

Drill-husbandry is that in which grain or other sorts of crops are sown or set, and cultivated in rows or drills, by means of implements constructed for the different purposes. In this method the seed is deposited with more exactness and regularity in the soil; and much attention bestowed on the after-culture of the crops by hoeing or stirring the ground between the rows, by means of ploughs or hoes contrived for the purpose, and drawn by horses. Hence, it has often been denominated the *horse-hoeing* husbandry. See *Broad-cast* and *Drill Husbandry.*

Where neither of these methods are distinctly pursued, but there is a sort of mixture of both, or where two crops of different kinds are grown together in alternate rows, we have what is often termed *half-husbandry*; and in cases where the land is cultivated alternately in the states of grass and tillage, we have that which writers on agriculture frequently denominate *convertible* husbandry. The friable loamy lands, according to Mr. Davis, are most adapted to this practice, while those of the wet clayey kind are wholly unfit for it.

Where extensive tracts of ground are cultivated under particular systems of management, from their being in a state of commonage, we have a sort of practice which is termed *common-field* husbandry.

In regard to grass-lands we have also *dairy, grazing,* and *grass-husbandry*, according as the farms are converted to the purposes of the dairy, the feeding of cattle, sheep, or other animals, and the making of hay.

In these views, it of course comprehends the whole of the operations, processes, or methods of management, that are necessary to be performed or followed

in the whole business of cultivation, whether with respect to tillage or grass-lands, or the breeding, rearing, and keeping, of different kinds of live-stock.

The culture of particular crops, such as turnips, potatoes, &c. likewise affords epithets of this kind, as *turnip*, *potatoe*, *carrot* husbandry, &c.

The improvements that have been gradually introduced in the instrumental department of the art, as well as in the modes of cropping and cultivating lands for these several years past, have had a considerable effect in promoting the advancement of almost every branch of husbandry, and of rendering the practices, in many respects, more easy, convenient, and advantageous.

The following calculations, made by the practical author of the "Experienced Farmer," upon an acre of land conducted under the *old* system of fallowing once in every three years, or two crops and a fallow, which was supposed not to *run* or exhaust the soil—and the *new* method of alternating green or cleaning crops with those of grain—show the differences in the expenses of cultivation for six years to be greatly in favour of the latter mode of management.

OLD SYSTEM.

	£.	s.	d.
First Year, Fallow.			
Four ploughings and harrowings, at 6*s*. each - - -	1	4	0
Twelve loads of manure, at 8*s*. per load	4	16	0
Second Year, Barley.			
Ploughing, harrowing, and sowing -	0	6	6
Weeding the crop - -	0	0	6
Third Year, Beans.			
Ploughing, harrowing, and sowing -	0	6	6
Weeding - - -	0	0	6
Fourth Year, Fallow.			
Ploughing three times, and harrowing, 6*s*. each time - -	0	18	0
Fifth Year, Wheat.			
Ploughing and sowing - -	0	6	0
Weeding - - -	0	0	6
Sixth Year, Oats.			
Ploughing and sowing - -	0	6	6
Weeding - - -	0	0	6
	£.8	5	6

NEW SYSTEM.

	£.	s.	d.
First Year, Turnips.			
Ploughing an inch and half deep -	0	4	0
Harrowing, raking, rolling, &c. -	0	3	6
Ploughing twice, harrowing, raking, &c. - - -	0	13	0
Leading off refuse - -	0	1	0
Seed and sowing - -	0	1	6
Making of drills - -	0	2	6
Three times ploughing the turnips, and hoeing - - -	0	8	6
Six loads of manure, at 8*s*. per load	2	8	0
Second Year, Barley.			
Ploughing and sowing, harrowing, &c.	0	6	6
Weeding - - -	0	0	3
Third Year, Beans or Peas.			
Two ploughings, harrowing, raking, &c. - - -	0	13	0
Drill-making - - -	0	2	6
Four loads of manure, at 8*s*. per load -	1	12	0
Three times ploughing, to mould the peas and destroy the weeds -	0	4	9
Leading off refuse - -	0	1	0
Fourth Year, Wheat.			
Scarifying - - -	0	2	6
Ploughing, sowing, &c. - -	0	6	0
Weeding - - -	0	0	3
Fifth Year, Clover.			
Sixth Year, Wheat.			
Ploughing and sowing - -	0	6	6
Weeding - - -	0	0	3
	£.7	17	6
Balance in favour of the new system	0	8	0
	£.8	5	6

The writer further remarks, that the expenses of the new mode are not only less by eight shillings than those of the old in the first six years, but will somewhat decrease in the next six; except in manure, which will be more, as in the new mode the reservoir and five crops of straw will, he supposes,

produce nearly double the quantity. The manure, in the first way, is all raised from the produce of the land it is laid on: but, to make his twelve loads, the *old* farmer robs, he says, the meadow or any piece of fresh land he is allowed to plough up. This is the principal cause, he thinks, why so many tenants are restricted from ploughing old swards, as they do not carry back the manure to its proper place, or apply it in a proper manner.

It is added, that in all his calculations he supposes that two loads of manure can be made from every acre of straw, if the crop be a good one. Therefore, says he, by the old system (admitting the crop to be a good one, which frequently is not the case), there would be only eight loads of manure raised in six years; and, by the new, ten loads, even without the assistance of the reservoir. But in the second six years, if the new plan be followed, he expects to have fourteen loads. In making the above statement, he has followed the usual mode of calculations upon agriculture, by charging the manure as an expense; which, however, he observes, is very wrong when it is not purchased, but produced from the land or soil.

If the above estimates be founded in truth, the superiority of the method by green crops instead of fallows cannot be disputed; but the annexed statements, by the same writer, of the differences in the two methods of management in the cultivation of farms of different descriptions, may afford more full and satisfactory proofs, and at the same time present the reader with a more exact view of the modes adopted in the several cases.

I. A *tillage farm*:—This consisted of 139 acres, and was situated in Yorkshire. The common method of management is first described, and then the method which, he thinks, ought to be pursued.

Method of Husbandry under the Old System.

Dr. to Expenses.

	£.	s.	d.
Twenty-three acres of wheat, ploughing, sowing, &c. at 7*s.* per acre -	8	1	0
Seed, twenty-three loads, at 18*s.* per load - - - - -	20	14	0
Reaping, leading, &c. at 10*s.* per acre	11	10	0
Threshing, dressing, 161 loads, at 1*s.* per load - - -	8	1	0
Mowing stubble, 3*s.* per acre -	3	9	0
Nine acres of barley, ploughing, &c. at 7*s.* per acre - - -	3	3	0
Seed, four quarters four bushels, at 25*s.* per quarter - - -	5	12	6
Reaping, leading, &c. at 8*s.* per acre	3	12	0
Threshing, &c. thirty-six quarters, at 1*s.* 6*d.* per quarter - - -	2	14	0
Twenty-three acres oats, ploughing, &c. at 7*s.* per acre - - -	8	1	0
Seed, fourteen quarters three bushels, at 12*s.* per quarter - - -	8	12	6
Reaping, leading, &c. at 6*s.* per acre	6	18	0
Threshing, &c. ninety-two quarters, at 1*s.* per quarter - - -	4	12	0
Four and half acres of beans, ploughing, &c. at 7*s.* per acre - -	1	11	6
Seed, two quarters two bushels, at 24*s.* per quarter - - -	2	14	0
Reaping, &c. at 8*s.* per acre - -	1	16	0
Twelve acres hay, harvesting, at 5*s.* per acre - - - - -	3	0	0
Twenty acres fallow, four times ploughing, &c. at 5*s.* 6*d.* per acre -	22	0	0
142 loads of manure, at 8*s.* per load	56	16	0
Rent - - - - - -	110	0	0
Assessments, at 5*s.* - - -	27	10	0
	320	7	6
Profit - -	130	8	6
	£450	16	0

Cr. by Produce.

	£.	s.	d.
Wheat, twenty-three acres, seven loads per acre, at 18*s.* per load - -	144	18	0
Barley, nine ditto, four quarters per acre, at 25*s.* per quarter - -	45	0	0
Oats, twenty-three ditto, four quarters per acre, at 12*s.* per quarter -	55	4	0
Beans, four and a half ditto, three ditto per acre, at 24*s.* per quarter -	16	4	0
59½ acres under plough			
20 in fallow			
59½ in grass			
139 total quantity of acres.			
Fifty-nine and a half acres straw, &c. at 1*l.* per acre - - - - -	59	10	0
Twelve ditto hay, at one ton per acre, 4*l.* per ton - - - - -	48	0	0
Profit on five cows, at 5*l.* 5*s.* per cow	26	5	0
Profit of a bull, per annum - -	5	5	0
Nine wethers - - -	18	0	0
Twenty fat lambs - - -	15	0	0
Wool, thirty fleeces, at 3*s.* each -	4	10	0
One horse (suppose) sold in two years, will be the half of a horse in this year's profits - - - -	8	0	0
Pigs - - - - - -	5	0	0
	£450	16	0

Method of Husbandry under the New System.

Dr. to Expenses.

	£.	s.	d.
Twenty Acres in Turnip, Fallow.			
Two ploughings, &c. carrying twitch off, &c. at 7*s*. each	14	0	0
Six loads of manure per acre, leading on, &c. at 8*s*. per load	48	0	0
Drilling, at 2*s* 6*d*. per acre	2	10	0
Seed, 6*d*. per acre	0	10	0
Hoeing, and three times ploughing, 2*s*. each time per acre	6	0	0
Twenty Acres Wheat-Crop.			
Ploughing, sowing, &c. 7*s*. per acre	7	0	0
Seed, twenty loads, 18*s*. per load	18	0	0
Reaping, and leading, 10*s*. per acre	10	0	0
160 loads threshing, &c. 1*s*. per load	8	0	0
Stubble mowing, &c. 3*s*. per acre	3	0	0
Twenty Acres Peas-Crop.			
Ploughing, harrowing, &c. twice, 7*s*. per acre each	14	0	0
Seed, ten quarters, at 32*s*. per quarter	16	0	0
Drill, 2*s*. 6*d*. per acre	2	10	0
Four loads of manure per acre, leading, &c. at 8*s*. per load	32	0	0
Three ploughings per acre, 1*s*. 6*d*. per acre each	4	10	0
Reaping and threshing 240 loads, at 8*d*. per load	8	0	0
Twenty Acres Barley-Crop.			
Ploughing, &c. and sowing, 7*s*. per acre	7	0	0
Seed, four bushels per acre, at 25*s*. per quarter	12	10	0
Clover-seed, 14lb. trefoil, 6lb.	8	10	0
Reaping and leading, at 8*s*. per acre	8	0	0
Threshing, &c. eighty quarters, at 1*s*. 6*d*. per quarter	6	0	0
Twenty Acres Clover-grass.			
Six loads of manure per acre, at 8*s*. per load	48	0	0
Mowing, &c. twice, 6*s*. per acre	12	0	0
Twenty Acres Wheat-Crop.			
Ploughing, sowing, &c. 7*s*. per acre	7	0	0
Seed, twenty loads, 18*s*. per load	18	0	0
Reaping and leading, 10*s*. per acre	10	0	0
Threshing, &c. at 1*s*. per load	8	0	0
Stubble mowing, at 3*s*. per acre	3	0	0
Rent and assessments	137	10	0
	479	10	0
Profit	452	10	0
	£932	0	0

Cr. by Produce.

	£.	s.	d.
Twenty acres turnips, at 4*l*. per acre	80	0	0
Twenty ditto wheat, eight loads per acre, at 18*s*. per load	144	0	0
Twenty ditto peas, twelve loads per ditto, at 12*s*. per load	144	0	0
Twenty ditto barley, four quarters per ditto, at 25*s*. per quarter	100	0	0
Twenty ditto clover, two ton per ditto, at 4*l*. per ton	160	0	0
Twenty ditto wheat, eight loads per ditto, at 18*s*. per load	144	0	0
Eighty acres straw, at 20*s*. per acre	80	0	0
Profit brought from account of ten acres managed according to the new system, as seen below.	80	0	0
	£932	0	0

He supposes the farm-houses, barns, and buildings in general, together with the fences on the whole farm, to occupy by admeasurement nine acres of land: there will then remain ten acres for the support of the cows, horses, &c. The best method to make the ten acres answer that purpose will be, he thinks, to sow three and a half of them with winter tares; two and a half with summer cabbages, and potatoes under them; and the remaining four with spring tares: or part of them may be sown with buck-wheat. He means these ten acres to supply the place of the fifty-nine acres and a half allowed for the same use in the old system, always supposing in both cases, that the buildings, fences, &c. take up nine acres. These ten acres will most certainly cost something tilling and managing; but, if carefully looked after they will, he thinks, maintain forty head of cattle and horses in summer, with the assistance of chopped straw, as before described; and the farmer will have 120 acres of straw, clover, &c. where he had before in the old method only fifty-nine and a half; and he may be certain that every crop by this management will be more bulky, and his quantity of manure continually increase by keeping forty head of cattle and horses in the fold winter and summer, not to mention pigs. As the food he has recommended is too rich for breeding stock, if the farmer keep six cows, as before mentioned, he will want twenty-six feeding beasts, which may average at five guineas each; but much more may be made—he may make two returns. However, as the profits accruing by this method may, he says, appear incredible to those who set their faces against any innovation or improvement, he will explain himself by a debtor and creditor account. We will, says he, suppose the ten acres to be at first set with potatoes, to make the land ready and clean for the tares, &c. Carry the profit on the potatoes to the general account, as it is part of the crop for the first year of the new method of management.

Ten Acres under Potatoes—New System.

Dr. to Expenses.	£.	s.	d.	*Cr. by Produce.*	£.	s.	d.
Ploughing ten acres, at 7*s.* per acre -	3	10	0	By ten acres, sold at 10*l.* 10*s.* per acre - - - -	105	0	0
120 sacks of potatoes for seed, at 3*s.* per sack - - - -	18	0	0				
Harrowing at different times, at 2*s.* per acre - - - -	1	0	0				
Ploughing up, at 5*s.* per acre -	2	10	0				
Profit carried to the general account of one year's profit - - -	80	0	0				
	£105	0	0		£105	0	0

He observes, that the potatoe-crop is supposed to be sold on the land, as it is difficult to calculate expenses when they are sold by the farmer at market, or he would make more than double the sum mentioned; for 100 sacks, at 3*s.* per sack, would be 15*l.* per acre, which would be 150*l.*; but, if well set and managed, he would have, he says, 150 sacks per acre.

Ten Acres of Land under the New System.

Dr. to Expenses.	£.	s.	d.	*Cr. by Produce.*	£.	s.	d.
Three and a half acres ploughing, harrowing, and sowing, at 7*s.* per acre	1	4	6	By the profit of thirty-two beasts, at an average of 5*l.* 5*s.* per beast -	168	0	0
Seed tares, two bushels per acre, at 10*s.* per bushel, and half a peck of rye at 6*d.* per peck - - -	3	11	9				
One acre and a half of cabbages, ploughing, &c. at 7*s.* per acre - -	0	10	6				
Two acres and a half drilling, at 2*s.* 6*d.* per acre - - - -	0	6	3				
Plants which must be raised on a seed-bed, 4lb. of seed, at 6*s.* per lb. digging the garden and sowing -	1	9	0				
Carried forward	7	2	0	Carried forward	168	0	0

Dr. to Expenses.

	£.	s.	d.
Brought forward	7	2	0
Planting, at 5*s.* per acre - -	0	12	6
Four acres, three times ploughing and sowing, at 7*s.* per acre - -	4	4	0
Manure for ten acres every year, at four loads per acre, at 8*s.* per load -	16	0	0
Profit by this mode - - -	140	1	6
	£168	0	0

Cr. by Produce.

	£.	s.	d.
Brought forward	168	0	0
	£168	0	0

He adds, that the above balance of profit certainly appears great; but the uncommon quantity of food the ten acres will supply by the tares and rye raised upon them (when chopped with wheat-straw, as he recommends) is really incredible to those who have not given the method a fair trial. He has, he says, kept ten horses thirteen months on six acres of *wheat-scouge*, and six acres of oats. From this it may easily, he thinks, be conceived, that ten acres of green fodder, with ten acres of wheat-straw, will keep forty head of cattle and horses during the summer. Forty acres of wheat-straw, twenty acres of clover twice mown, twenty acres of barley-straw, and twenty acres of pea-straw, together with twenty acres of turnips, will easily keep thirty-two head of beasts and eight horses during the winter. No one can suppose that he means the ten acres alone should keep the number of the different cattle mentioned. He intends that the produce of the ten acres, when appropriated to the raising of green fodder, if mixed with the straw and clover in the manner he recommends, and properly and regularly given to the cattle, will be found to answer the purpose, and render every service he has asserted it capable of performing.

He remarks further, that cabbages of the early kind will be ready to cut the beginning of June; and that they may be kept in cutting all the summer, as, before a certain quantity are gotten through, the sprouts of others will be ready to cut again. It is meant that these cabbages should be given to such beasts as are in the best condition, or nearest ready for market. When the winter tares and rye have been cut, savoy-cabbages must be put in the land. The tares will be mown in summer; and the cabbages will serve the cattle in winter, and be soon enough removed from the ground to sow it with tares in the spring. Where the spring cabbages have grown, winter tares must be sown in drills in autumn, putting in four or six loads of manure per acre to every crop. These ten acres are, like a garden, continually to be covered with crops: he indeed esteems them as much a garden for the use of the cattle, as he does the kitchen-garden for the use of the family.

But although he has calculated twenty acres of turnips to be used for the feeding of cattle in the fold, they will not all, he observes, be wanted, but one half, or perhaps more, may often be eaten with sheep; therefore a profit will arise of which no notice has been taken above. The quantity of manure calculated in the new system is also, he thinks, very much less than will arise; but as the method is but little practised or known in many parts, he has wished to avoid placing over much profit before the reader at once.

But, says he, suppose to the new method one man and one boy extra be allowed to look after the cattle, horses, &c.—if the man be estimated at 12*s.* per week, and the boy at 6*s.* per week—though such wages may appear at first sight rather extravagant, yet, as Sunday's attendance will be required for a part of the day at least, a liberal allowance should be made:—therefore, throwing away the odd day, the hours and minutes, and reckoning fifty-two weeks for the year, we have the sum of 46*l.* 16*s.* to deduct, which will leave a balance of 405*l.* 14*s.* Now, says he, the profit by the old system is 130*l.* 8*s.* 6*d.* which taken from 405*l.* 14*s.* leaves a net difference in profit in favour of the new system of 275*l.* 5*s.* 6*d.*

He adds, that in the old system he reckoned the profit of a horse in two years 16*l.*, the half of which, taking only for one year, will be 8*l.* and of pigs, as before, 5*l.* These sums added to 275*l.* 5*s.* 6*d.* will make in the aggregate 288*l.* 5*s.* 6*d.* The 80*l.* for the potatoes has only been brought to account; but the net profit from the ten acres, in green crops, being 140*l.* 1*s.* 6*d.*, will make the aggregate sum 348*l.* 7*s.* 0*d.*, which appears to be a very large sum. But, by this method of cultivation and feeding of cattle, it will be found, he says, that manure will be made of so much better quality, and in such plenty, and at so much cheaper rate than by buying, which has been the general practice in the neighbourhood of the farm, that a farmer who lives four or six miles from a post or manufacturing town will scarcely be at the trouble of fetching it; and manure, being the master-piece of all agriculture, will, he supposes, raise every crop to be extremely abundant.

He concludes his account, however, by remarking, that there are several advantages in respect to situation attending this farm, which from their locality will not apply to the others mentioned below. It may be said the profit on the beasts is laid too high, but he denies that to be the case on these grounds:—"When (says he) cattle are fed on grass, it is possible that the seasons may vary so much that the same pasture might keep double the number of cattle at one time to what it may be capable of at another. Therefore, as it is usual to put in the same number

every year, should the season prove dry, it will probably be over-loaded with stock; if, on the contrary, it should prove wet, it will be deficient in stock: and in either of these cases the cultivator will be disappointed. But with food provided in the manner described above, the green crops get so forward before the dry season probably arrives, that they receive no injury; and by fold or stall feeding, the animal, if chosen of the right sort, to a certainty speedily becomes fat. His food, his work, his rest is regular: every day is the same, and every day he increases to the profit of his owner." The contiguity of markets also affords advantages in various ways; by the sale of, and jobbing in, cattle, as well as in the strength of teams required.

It is to be observed, he says, that in the above calculations he has supposed that all the ploughing, sowing, and leading should be hired and paid for. These accounts, as drawn out, consequently incline much in favour of the old system, as the expenses are fewer in number than will really be found in following that method. They are made, it is remarked, for the purpose of showing at one view the great disparity which actually will be found to exist in the practice of the two different methods on similar farms. As to ascertaining the profits exactly, that is, he thinks, impossible; as the markets fluctuate in so great a degree, that no one can be correct in the valuation of cattle or corn for six months forward. He has however, he says, constantly estimated the expenses at a higher rate than he knows they may be done at, that he might not be supposed to deal unfairly with the old method of husbandry.

The large statements contained in the preceding account, whether they be the result of actual experience or not, clearly demonstrate that great advantages may be derived from the cultivation of cattle-crops, and a judicious application of them in the feeding of beasts or other kinds of live-stock.

The calculations given below represent the advantages of the different systems of management where there is a combination of several kinds of husbandry on the same farm, or where it is conducted under a sort of convertible system.

II. A *grazing*, *breeding*, and *ploughing-farm*.—It is situated in Lincolnshire, and consists of 314 acres of land. Part of it is, the writer says, at present divided into four plats for ploughing, each plat consisting of twenty-four acres. There is also an additional plat of the same kind of land, containing sixteen acres, and about fourteen acres of clay-land, which is also ploughed. The four plats, consisting of twenty-four acres each, and the plat of sixteen acres, are on a limestone soil; the rest clay, and liable to rot sheep. These added together make, he says, 126 acres, all under the plough, according to the old management. If, continues he, you subtract the 126 acres from 314, there will be a residne of 188 acres, which are all in grass, and used, he says, for the purpose of raising 140 lambs, or tupping 140 ewes (as the hog-sheep are sold off in the spring, and the drape-ewes at Michaelmas), and keeping twelve horses and thirty beasts. The course of cropping made use of is according to the old system, as observed above, viz. turnips, barley, clover, and wheat; which is probably, he says, as good as any other, as the farm is applied to the breeding of sheep, the most lucrative business the farmer can pursue. The expenses and produce of the farm, as now managed, are these:—

Annual Method of Husbandry under the Old System.

Dr. to Expenses.

First Plat.	£.	s.	d.
To fallowing twenty-four acres for turnips; four times ploughing, harrowing, &c. at 6*s.* per acre each - -	28	16	0
Twelve loads of manure per acre, at 8*s.*	115	4	0
Seed and hoeing, 6*s.* per acre -	7	4	0
Second.			
Ploughing twenty-four acres for barley, at 7*s.* per acre - - - -	8	8	0
Seed, four bushels per acre, at 25*s.* per quarter - - - - -	15	0	0
Clover-seed, 14lb. per acre, at 6*d.* per lb. - - - -	8	8	0
Reaping and leading, at 6*s.* per aere	7	4	0
Threshing, &c. ninety-six quarters, at 1*s.* 4*d.* per quarter - -	6	8	0
Third.			
Clover, mowing, &c. twenty-four acres, at 3*s.* per acre - - -	3	12	0
Carried forward	£200	4	0

Cr. by Produce.

	£.	s.	d.
By twenty-four acres turnips, at 3*l.* 10*s.* per acre - - - -	84	0	0
Twenty-four acres barley, four quarters per acre, at 25*s.* per quarter -	120	0	0
Twenty-four acres clover, one ton and a half per acre, at 1*l.* per ton -	36	0	0
Twenty-four acres clover eaten off, at 10*s.* 6*d.* per acre - - -	12	12	0
Twenty-four acres wheat, three quarters per acre, at 2*l.* per quarter - -	144	0	0
Sixteen acres of cliff-land, which appear to be carried on in the same manner, but do not seem to be regular in any crop. Therefore takes the average of its produce from the produce of the ninety-six acres above, which are regularly cropped (as the land is of the same kind); but being rather better, will say 4*l.* 10*s.* per acre - -	72	0	0
Carried forward	£468	12	0

	£.	s.	d.
Brought forward	£200	4	0
Fourth.			
Twenty-four acres ploughing for wheat, 7*s.* per acre - - - -	8	8	0
Seed, three bushels per acre, at 5*s.* per bushel - - - - -	18	0	0
Reaping and leading, 10*s.* per acre -	12	0	0
Threshing, &c. seventy-two quarters, 1*s.* 8*d.* per quarter - -	6	0	0
Stubble mowing, 3*s.* per acre -	3	12	0
Average expense upon the sixteen acres of cliff-land - - -	43	1	0
Fallowing one-third of fourteen acres of clay-land - - - - -	6	10	8
Manure once in three years - -	16	16	0
Rent and assessments - -	316	4	4
Profit - - - -	318	9	11½
	£949	6	0½

	£.	s.	d.
Brought forward	£468	12	0
Seven acres of wheat on clay-land, at three quarters per acre, at 2*l.* per quarter - - - - -	42	0	0
Seven acres beans on ditto, three quarters per acre, 1*l* 4*s.* per quarter -	25	4	0
Sixty-five hogs (feeders), at 1*l.* 8*s.* each	91	0	0
Fifty ewes (drape), at 1*l.* 8*s.* each -	70	0	0
200 fleeces of wool, at 1*l.* 1*s.* per tod, four fleeces to a tod - -	52	10	0
Six fat beasts, 25*l.* each - -	150	0	0
Two horses, at 20*l.* each - -	40	0	0
Pigs - - - -	10	0	0
	£949	0	0
Profit brought down - -	318	9	11½

Annual Method of Husbandry under the New System.

Dr. to Expenses.

First Plat.	£.	s.	d.
To ploughing, &c. twice for turnips on twenty-four acres twitch, &c. raking off, at 6*s.* per acre - -	14	8	0
Drilling and sowing, 2*s.* 6*d.* per acre	3	0	0
Seed, 1*s.* per acre - - -	1	4	0
Hoeing, and three times ploughing, at 1*s.* 6*d.* per acre - - -	5	8	0
Six loads manure, per acre, at 8*s.* per load - - - -	57	12	0
Second.			
Ploughing, &c. and sowing, twenty-four acres for barley, at 7*s.* per acre	8	8	0
Seed, four bushels, at 25*s.* per quarter - - - - -	15	0	0
Red-clover, 14lb. per acre, at 6*d.* per lb.; trefoil, 6lb. per acre, at 3*d.* per lb.; white clover, 6lb. per acre, at 8*d.* per lb. - - -	15	0	0
Reaping and leading, 6*s.* per acre -	7	4	0
Threshing ninety-six quarters, at 1*s.* 4*d.* per quarter - - -	6	8	0
Third.			
To clover, twenty-four acres eaten by sheep			
Fourth.			
Twenty-four acres wheat, ploughing, &c. at 7*s.* per acre - -	8	8	0
Carried forward	£142	0	0

Cr. by Produce.

	£.	s.	d.
By twenty-four acres of turnips, at 3*l.* 10*s.* per acre - - -	84	0	0
Twenty-four acres barley, four quarters per acre, at 1*l.* 5*s.* per quarter -	120	0	0
Clover eaten by sheep, carried to general account			
Twenty-four acres wheat, three quarters per acre, at 2*l.* per quarter -	144	0	0
Sixteen acres sainfoin, two tons per acre, at 2*l.* per ton - -	64	0	0
Carried forward	£412	0	0

	£.	s.	d.
Brought forward	142	0	0
Seed, three bushels per acre, at 5*s.* per bushel	18	0	0
Reaping, &c. at 10*s.* per acre	12	0	0
Seventy-two quarters wheat, threshing, &c. at 1*s.* 8*d.* per quarter	6	0	0
Stubble mowing, 3*s.* per acre	3	12	0
Fifth.			
Sixteen acres sainfoin mowing, 3*s.* per acre	2	8	0
Profit	228	0	0
	£412	0	0

	£.	s.	d.
Brought forward	412	0	0
	£412	0	0
Profit brought down	£228	0	0

General Account of Expenses and Produce under the New System.

This is on a Lincolnshire farm of eighty-four acres, which at present rots sheep.

Dr. to Expenses.

	£.	s.	d.
First.			
Fourteen acres wheat, ploughing, &c. at 7*s.* per acre	4	18	0
Seed, three bushels per acre, 5*s.* per bushel	10	10	0
Reaping, &c. 10*s.* per acre	7	0	0
Threshing, &c. forty-nine quarters, at 1*s.* 8*d.* per quarter	4	1	8
Stubble mowing, 3*s.* per acre	2	2	0
Second.			
Fourteen acres beans or peas ploughing, 7*s.* per acre	4	18	0
Drilling, at 2*s.* 6*d.* per acre	1	15	0
Four loads of manure per acre, at 8*s.* per load	22	8	0
Three times ploughing, at 1*s.* 4*d.* each per acre	2	16	0
Reaping, &c. 6*s.* per acre	4	4	0
Threshing, &c. fifty-six quarters, at 1*s.* per quarter	2	16	0
Third.			
Fourteen acres barley, ploughing, at 7*s.* per acre	4	18	0
Seed, four bushels per acre, at 1*l.* 5*s.* per quarter	8	15	0
Clover-seed, 14lb. per acre, at 6*d.* per lb.; 6lb. trefoil, at 3*d.* per lb.	5	19	0
Reaping and leading, 8*s.* per acre	5	12	0
Threshing fifty-six quarters, at 1*s.* 2*d.* per quarter	3	5	4
Fourth.			
Fourteen acres clover, mowing, &c. at 6*s.* per acre	4	4	0
Six loads of manure per acre, at 8*s.* per load	33	12	0
Carried forward	£133	14	0

Cr. by Produce.

	£.	s.	d.
By fourteen acres of wheat, three quarters and a half per acre, at 2*l.* per quarter	98	0	0
Fourteen acres peas or beans, four quarters per acre, at 1*l.* 4*s.* per quarter	67	4	0
Fourteen acres barley, four quarters per acre, at 1*l.* 4*s.* per quarter	70	0	0
Fourteen acres clover, two tons and a half per acre, at 2*l.* per ton	70	0	0
Fourteen acres wheat, four quarters per acre, at 2*l.* per quarter	112	0	0
Fourteen acres beans, four quarters per acre, at 1*l.* 4*s.* per quarter	67	4	0
Profit brought from the four plats	228	0	0
Profit on beasts, horses, sheep, wool, pigs, &c. brought from account in old system, being the same in new	413	10	0
Carried forward	£1125	18	0

Dr. to Expenses.

Fifth.	£.	s.	d.
Brought forward	133	14	0
Fourteen acres wheat, ploughing, &c. at 7*s*. per acre - - -	4	18	0
Seed, three bushels per acre, at 5*s*. per bushel - - - -	10	10	0
Reaping, &c. at 10*s*. per acre -	7	0	0
Threshing, &c. fifty-six quarters, at 1*s*. 8*d*. per quarter - -	4	13	4
Stubble mowing, 3*s*. per acre -	2	2	0
Sixth.			
Fourteen acres beans, ploughing, &c. at 7*s*. per acre - - -	4	18	0
Drilling, at 2*s*. 6*d*. per acre -	1	15	0
Six loads of manure per acre, at 8*s*. per load - - - -	33	12	0
Three times ploughing, at 1*s*. 6*d*. each per acre - - - -	3	3	0
Reaping, threshing, &c. - -	7	0	0
Rent and assessment as in the old system account - - - -	316	4	4
Profit - - - -	596	8	3½
	£1125	18	0

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Cr. by Produce.

	£.	s.	d.
Brought forward	1125	18	0
	£1125	18	0

This management is explained by Mr. Parkinson in the following manner:

100	Acres of grass, three sheep to every two acres - - -	150 *sheep*
10	Ditto for feeding beasts, and a few tups - - - -	4 *tups*
72	Ditto for ploughing (in three plats) as before described: with	
24	Ditto sown with grasses to keep sheep upon, five to an acre -	120 *sheep*
		274
84	Ditto clay soil, under rotation of crops	
16	Ditto of sainfoin for hay	
8	Ditto of meadow to cut green, for the purpose of soiling horses in the fold or stable:	
314	Acres.	

which he considers the most beneficial method of keeping them; and, beyond comparison, preferable to letting them run over the grass, if only for the benefit of the manure, which will be found of such vast value to the farm."

It is suggested that, on such a farm, he should keep at least forty head of cattle and horses, winter and summer, in the fold-yard, and stable; but that twice that number might be kept; which, by means of the green food, would raise a vast supply of manure of a much better quality than that raised in the winter in the usual system of management. Besides, by mixing the straw with the green food, it may be consumed to much greater advantage, than in the common mode of using it; and at the same time the stock supported in much better condition.

It is supposed, that the accident of the land's rotting sheep is obviated by the converting the eighty-four acres of clay-land into tillage, and the practice of "eating the seeds, sainfoin-edish, &c. And the injury of the horses in this way may be avoided by the soiling of them in the stalls and yards, by which most of them may be kept up."

And as the number of sheep is augmented by seventy, if his calculation be correct, instead of selling the hog-sheep, they may be kept for wethers. But, in case of danger from rot, the cattle stock may be increased, and be perhaps as profitable retaining only the old number of sheep (200) to clip; the seeds on the twenty-four acres (part of the ninety-six acres estimated to keep five by being seeded), in the spring, being consumed by the proportion of four sheep to the acre: but suppose the number to be a hundred, as fifty of the last sheeder-hogs, and the same quantity of shearling ewes, there only remains then a hundred sheep for one hundred acres of grass-land, and consequently there must be a capability of keeping many additional beasts, or of converting some of the ground to the state of meadow.

And though the common custom to sell off the drape-ewes, by taking the lambs from them very early in June, or the following month, it is supposed that the ewes may have sufficient time to become fat before the winter sets in, and be sold; and the sixteen acres of sainfoin-edish is stated to insure a profit on the sheep, superior to that commonly made. And that the lambs, by being taken to the

sainfoin, would be preserved sound, while the ewes are in the state of fattening.

On a third farm, the following debtor and creditor statements on a course of crops for six years, on an acre of land upon an extensive estate in the North Riding of Yorkshire, consisting of several hundreds of acres of open tillage lands on the old system, employed in a great many parts of that district as the best or most advantageous.

The course of husbandry being one fallow and two crops, that is:

1st year, fallow, manured;
2d year, barley:
3d year, beans;
4th year, fallow;
5th year, wheat;
6th year, oats.

Old System.

Dr. to Expenses.	£. s. d.	*Cr. by Produce.*	£. s. d.
First Year, Fallow.			
Four ploughings and harrowings, &c. at 7*s.* - - - -	1 8 0		
Twelve loads of manure, at 8*s.* per load - - - -	4 16 0		
One year's rent - - -	0 15 0		
Assessments - - -	0 10 0		
Tithe - - - -	0 6 0		
	7 15 0		
Second Year, Barley.			
Ploughing and harrowing - -	0 6 6	Four quarters of barley, at 1*l.* 5*s.*	5 0 0
Seed, four bushels - - -	0 12 6	Straw - - - - -	1 0 0
Reaping and threshing - -	0 12 6		
Rent - - - -	0 15 0		
Assessments - - -	0 10 0		
Tithe - - - -	0 6 0		
	3 2 6		6 0 0
Third Year, Beans.			
Ploughing and harrowing - -	0 6 6	Three quarters of beans, at 1*l.* 12*s.* per quarter - - - -	4 16 0
Seed, four bushels - - -	0 16 0	Straw - - - -	1 0 0
Reaping and threshing - -	0 12 0		
Rent - - - -	0 15 0		
Assessments - - -	0 10 0		
Tithe - - - -	0 6 0		
	3 5 6		5 16 0
Fourth Year, Fallow.			
Ploughing three times, harrowing, &c.	1 1 0	No crop - - - -	0 0 0
Rent - - - -	0 15 0		
Assessments - - -	0 10 0		
Tithe - - - -	0 6 0		
	2 12 0		
Fifth Year, Wheat.			
Ploughing - - - -	0 5 0	Three quarters of wheat, at 2*l.* 10*s.* per quarter - - - -	7 0 0
Seed wheat, three bushels -	0 18 9	Straw - - - -	1 0 0
Rent - - - -	0 15 0		
Assessment - - -	0 10 0		
Tithe - - - -	0 6 0		
Reaping and threshing - -	0 15 0		
	£3 9 9		£8 0 0

Dr. to Expenses.	£. s. d.	*Cr. by Produce.*	£. s. d.
Sixth Year, Oats.			
Ploughing and harrowing - -	0 6 6	Four quarters of oats, at 16*s.* per quarter - - - -	3 4 0
Seed, four bushels - - -	0 8 0	Straw - - - -	1 0 0
Rent - - - -	0 15 0		
Assessments - - -	0 10 0		
Tithe - - - -	0 6 0		
Reaping and leading - -	0 6 6		
Threshing - - -	0 4 0		
	£2 16 0		4 4 0
		Total of the Cr. side - -	£24 10 0
		Total of the Dr. side - -	23 0 9
		Profit on one acre of land for six years	£1 9 3

A course of crops on the same land for six years under the New System, is stated to be this:

1st year, turnip fallow: 4th year, wheat or oats:
2d year, barley: 5th year, clover:
3d year, pea fallow: 6th year, wheat:

New System.

Dr. to Expenses.	£. s. d.	*Cr. by Produce.*	£. s. d.
First Year, Turnips.			
Ploughing $1\frac{1}{2}$ inch deep - -	0 4 0	Turnips - - - -	4 0 0
Harrowing and raking - -	0 3 6		
Ploughing harrowing, and raking -	0 7 6		
Ploughing and harrowing - -	0 5 0		
Making drills - - -	0 2 6		
Leading refuse - - -	0 2 6		
Manure, six loads, at 8*s.* per load	2 8 0		
Rent and assessments - -	1 5 0		
Tithe - - - -	0 6 0		
Seed and bush-harrowing - -	0 1 6		
Hoeing - - - -	0 1 0		
Ploughing three times - -	0 4 6		
	5 11 0		4 0 0
Second Year, Barley.			
Ploughing and harrowing - -	0 7 6	Barley, four quarters, at 1*l.* 5*s.* per quarter - - - -	5 0 0
Seed, four bushels - -	0 12 6	Straw - - - -	1 0 0
Rent and assessments - -	1 5 0		
Tithe - - - -	0 6 0		
Reaping and threshing - -	0 12 0		
	3 3 0		6 0 0
Third Year, Peas.			
Ploughing, harrowing, and raking	0 7 6	Four quarters of peas, at 1*l.* 12*s.* per quarter - - - -	6 8 0
Ditto, a second time - -	0 7 6	Straw - - - -	1 0 0
Making drills - - - -	0 2 6		
Manure, four loads, at 8*s.* per load	1 12 0		
Carried forward	£2 9 6	Carried forward	£7 8 0

Dr. to Expenses.	£.	s.	d.	*Cr. by Produce.*	£.	s.	d.
Brought forward	2	9	6	Brought forward	7	8	0
Bush-harrowing	0	0	3				
Seed, four bushels	0	16	0				
Three times ploughing	0	4	6				
Reaping and threshing	0	12	0				
Rent and assessments	1	5	0				
Tithe	0	6	0				
	5	13	3		7	8	0
Fourth Year, Wheat.							
Scarifying and harrowing	0	3	0	Three quarters of wheat, at 2*l.* 10*s* per quarter	7	10	0
Ploughing and sowing	0	5	0	Straw	1	0	0
Seed wheat, three bushels	0	18	9				
Rent and assessments	1	5	0				
Tithe	0	6	0				
Reaping and threshing	0	15	0				
Clover-seed, 20lb.	0	10	0				
	4	2	9		8	10	0
Fifth Year, Clover.							
Mowing and reaping	0	5	0	$1\frac{1}{2}$ ton of clover	6	0	0
Rent and assessments	1	5	0				
Tithe	0	6	0				
Four loads of manure, at 8*s.* a load	1	12	0				
	3	8	0		6	0	0
Sixth Year, Wheat.							
Ploughing and sowing	0	6	6	Four quarters of wheat, at 2*l.* 10*s.* per quarter	10	0	0
Seed, three bushels	0	18	9	Straw	1	0	0
Reaping and threshing	0	17	0				
Rent and assessments	1	5	0				
Tithe	0	6	0				
	£3	13	3		11	0	0
				Total of the produce	£42	18	0
				Total of the expense	25	11	3
				Profit of one acre of land for six years	£17	6	9

It is concluded, on these grounds, that, under the old system of management, the farmer derives only 1*l.* 9*s.* 3*d.* profit per acre from his farm, in six years, or 4*s.* $10\frac{1}{2}$*d.* per acre per annum. And the expense of labour is said to be stated higher than it really costs, or he could not support his family, and pay his rent: while, under the new system, in the same length of time, the profit is 17*l.* 6*s.* 9*d.* which affords 2*l.* 17*s.* $9\frac{1}{2}$*d.* per acre per annum, or more than a hundred per cent. in favour of the new method of husbandry.

It is further suggested, that in this farm there is an open pasture, known by the name of the Horse-car, which is let at half-a-crown the acre, and the tenants consider it of no use to them; but, under proper culture, it is supposed that five pounds per acre of annual profit might be obtained from it. Of course, it is observed, "the tenant may well be surprised when he is charged a new rent of 1*l.* 8*s.* an acre, though he now pays only 15*s.* an acre;" and the writer supposes him as high-rented, according to the system of husbandry which he pursues.

It is calculated, that "the loss sustained at this rate, on two thousand acres of land, is 29,625*l.* in six years. If (adds the writer), that number of acres were let at 1*l.* 8*s.* an acre yearly, there would be an advance of thirteen shillings an acre, which would raise the sum of 7000*l.* more for the tenants to pay in six years." And that, "that sum, taken from 29,625*l.* will still leave them a profit of 21,825*l.*

It is suggested, that, however these calculations may surprise those unacquainted with the subject, they have their foundation on facts; and, by proper courses being adopted, the profits stated above may be afforded to the landlord as well as the tenant, independently of the advantages of green fodder in the summer-season. It is added that, by a superiority of management, the East Lothian farmers are enabled to pay three or four pounds an acre. If, continues the writer, a person who lives by horticulture, was "to dig his ground one year in three, and the third year raise no crop, he would be considered as a madman." However, the two crops and a fallow are worse, as the land is, in this way, robbed of one third of its manure. It is supposed, that this "may be called opening the eyes of the landlord," but it is likewise much to the advantage of the tenant.

These statements and observations, though they must be considered as having, in some measure, a relation to the particular situations of the farms and lands, strongly show the great advantages and improvements that are capable of being derived from the introduction of those new modes of husbandry, that have been practised with success, in all cases where the circumstances of the land will admit of them.

But, in order to show more extensively the advantages and disadvantages of different methods of husbandry, the same practical author has presented the cultivator with comparative statements of the profit of a farm of four hundred acres, conducted under different modes of management, and in different circumstances, as:

1st. In the grazing system.
2d. In the dairy practice.
3d. In the hay-selling method.
4th. In tillage near a large town.
5th. In ditto more remotely situated.
6th. In tillage by an improved course of crops.

After suggesting, that "it is not rent that makes the farmer poor or rich, but the difference in his management of the farm," or the system of husbandry that is pursued, as a proper method of management improves land particularly under tillage, in a more expeditious manner than any thing else; he proceeds to offer some estimates, which fully show the great superiority which the tillage system has over any other method that may be practised on the same land or farm. The rent is fifty shillings the acre, and the ground of a sufficiently rich quality for affording profitable crops, when managed under a judicious system of husbandry.

Farm under the Grazing System.

In this case, the proportion of grazing land is supposed to be three hundred acres;—in meadow, seventy; and in tillage, thirty. Live-stock on 200 acres: 150 oxen bought in at 25*l.* per head, and sold off at 30*l.* each: And, on the remaining 100 acres, 75 cows, at 17*l.* each; 4 milch-cows; 300 ewes, bought at 45*s.* each, and sold at 70*s.*, to breed lambs for market; and 3 tups, at 5*l.* each. "The produce of lambs 400, sold at 35*s.* each; the wool of the ewes, 5lb. each fleece, and sold at 40*s.* a tod. Eight horses, and six pigs." The statement is as below:

Expenses of Stock, &c. (Account 1).

	£.	s.	d.		£	s.	d.
				Brought forward	£6104	0	0
Purchase of 150 oxen, at 25*l.* each	3750	0	0	2 Carts, at 17*l.*	34	0	0
75 Cows, at 17*l.*	1275	0	0	2 Ploughs, at 5*l.* 5*s.*	10	10	0
300 Ewes, at 45*s.*	675	0	0	2 Pair of harrows	13	2	6
				A scarifier	15	15	0
	£.5700	0	0	A roller	5	5	0
4 Milch cows, at 20*l.*	80	0	0	A wheelbarrow	1	1	0
8 Horses, at 30*l.*	240	0	0	A machine to dress corn	13	13	0
3 Rams, at 5*l.*	15	0	0	Shovels, spades, forks, scuttles, measures, &c.	10	0	0
6 Pigs, at 30*s.*	9	0	0	Household furniture	200	0	0
2 Waggons, at 30*l.*	60	0	0				
Carried forward	£6104	0	0		£.6407	6	6

Stock. (Account 2).

Expenses.	£.	s.	d.	*Returns.*	£.	s.	d.
Purchase of stock, as in the first part of account 1	5700	0	0	Sale of 150 Oxen, at 30*l.* each	4500	0	0
				of 75 Cows, at 21*l.* each	1575	0	0
Carried forward	£5700	0	0	Carried forward	£6075	0	0

	£.	s.	d.
Brought forward	£5700	0	0
20 oxen to eddish, and the hay in the winter, at 25*l.* each	500	0	0
2 servant-men and a boy	28	0	0
2 servant-girls	12	0	0
Housekeeping	200	0	0
Clothing for the family	50	0	0
Harvesting 70 acres of hay, at 10*s.*	35	0	0
Clipping the sheep and sundries	5	0	0
Mowing and grubbing thistles on grazing land, at 6*d.* an acre	7	10	0
Harness for 8 horses, at 3*l.* each	24	0	0
The farmer's expenses in doing the business	70	0	0
	£.6631	10	0

	£.	s.	d.
Brought forward	£6075	0	0
Sale of 300 Ewes, at 70*s.*	1050	0	0
of 53½ Tods of wool, at 40*s.*	107	0	0
of 400 Lambs, at 35*s.*	700	0	0
of 4 Calves, at 5*l.*	20	0	0
of 20 Oxen, at 34*l.*	680	0	0
Profit on a horse	5	0	0
on 6 Pigs	6	0	0
on sale of a cow and a calf	3	0	0
Total	£8646	0	0
Expense	6631	10	0
Profit	£.2014	10	0

Tillage Part. *(Account 3).*

Expenses.

Wheat, Ten Acres.

	£.	s.	d.
Ploughing three times for fallow, at 17*s.* an acre each time	25	10	0
Seed ploughing, at 17*s.* an acre	8	10	0
Seed, 3 bushels an acre, at 9*s* 6*d.* each	14	5	0
Weeding, at 6*d.* an acre	0	5	0
Harvesting, at 18*s.* an acre	9	0	0
Threshing, 3 quarters an acre, at 2*s.* 6*d.* per quarter	3	15	0
	61	5	0

Returns.

	£.	s.	d.
30 Quarters of wheat, at 3*l.* 16*s.* per quarter	114	0	0
Total	114	0	0
Expenses	61	5	0
Profit	52	15	0

Beans, Ten Acres.

	£.	s.	d.
Ploughing, at 17*s.* an acre	8	10	0
Seed, 3 bushels an acre, at 4*s.* 4½*d.* each	6	11	3
Hoeing, at 6*s.* an acre	3	0	0
Harvesting, at 14*s.* an acre	7	0	0
Threshing 3 quarters an acre, at 1*s.* 6*d.* a quarter	2	5	0
	£27	6	3

	£.	s.	d.
30 Quarters of beans, at 35*s.* per quarter	52	10	0
Total	52	10	0
Expenses	27	6	3
Profit	25	3	9
Total Profit on the two crops	£77	18	9

The expense of three times ploughing the ten acres that were *summer-fallowed* for wheat, is charged in the wheat-crop.

(Account 4).

Expenses of the Land, &c.

	£.	s.	d.
Rent, 400 acres, at 50*s.*	1000	0	0
Assessments, at 6*s.* in the pound	300	0	0
Taxes	150	0	0
Interest of capital laid out in buying stock, &c. as in account above, 6407*l.* 6*s.* 6*d.* at 8 *per cent.*	512	12	0
Total	£1962	11	8

Returns.

	£.	s.	d.
Profit on grazing 370 acres, as by account 2	2014	0	0
Arable, 30 acres, as by account 3	77	18	9
Total	2092	8	9
Expenses	1962	11	8
Total profit	£129	17	1

Farm under the Dairy System.

The farm is here supposed, as above, to be principally in the state of grass, but conducted under dairying: in which there are 220 acres of the land in pasture, 150 in meadow, and thirty in tillage. The stock of cows, allowing an acre and a half to each, will be 140; with a bull or two, and six horses. Profit on cows, in calves, butter, and milk for pigs, 15*l.* each. The stock of sheep, one ewe to the acre on the pasture-land, is 200 ewes bought in to breed lambs: the ewes and lambs to be made fat, and sold off, fresh stock being purchased annually: the produce in lambs will be 250, selling at 35*s.* each; and the ewes will cost 45*s.* each; when fat, will sell for 70*s.* each; their wool, at 5lb. each fleece, will make 35 tods 20lb., selling at 40*s.* the tod. The cows, when bought at three years old, will cost 17*l.* each; and, after having three calves, sell for 20*l.* each: Hence, in this way, there will be about thirty-five cows to be changed every year. A horse will also be to be sold annually, and one purchased. The tillage-land the same as in the grazing farm;—10 acres of wheat, 10 acres of beans, and 10 acres in summer-fallow. The whole of the statement will then be as below:

Expenses of Stock, &c. (*Account* 5).

	£.	s.	d.
Purchase of 200 ewes, at 45*s.*	450	0	0
2 rams, at 5*l.*	10	0	0
	460	0	0
140 Cows, at 17*l.* each	2380	0	0
2 Bulls, at 10*l.*	20	0	0
6 Horses, at 30*l.*	180	0	0
2 Waggons, at 30*l.*	60	0	0
2 Carts, at 17*l.*	34	0	0
2 Ploughs, at 5*l.* 5*s.*	10	10	0
2 Pair of harrows	13	2	6
Carried forward	£3157	12	6

	£.	s.	d.
Brought forward	3157	12	6
A scarifier	15	15	0
A roller	5	5	0
A wheelbarrow	1	1	0
A machine for dressing corn	15	15	0
Spades, shovels, forks, scuttles, measures, &c.	10	0	0
Household furniture	200	0	0
Churns, leads, milk-pails, &c.	100	0	0
Harness for horses, at [illegible]*l.* each	18	0	0
Total	£3523	8	6

Dairying and Stock. (*Account* 6.)

Expenses.

	£.	s.	d.
Purchase of stock, as in first part of account 1	460	0	0
20 milkers, at 10*s.* a week each	520	0	0
Wages of four dairy-maids	36	0	0
Houskeeping	300	0	0
Clothing for the family	50	0	0
Clipping the sheep and sundries	3	10	0
Mowing and grubbing the thistles on the pasture land, at 6*d.* an acre	5	10	0
Two servants to do the farming business	18	18	0
The farmer's expenses in doing the business	50	0	0
Harvesting 150 acres of hay, at 10*s.* an acre	75	0	0
Total	£1518	18	0

Returns.

	£.	s.	d.
The produce from 140 cows, at 15*l.* from each	2100	0	0
Wool, 35 tods and 20lb, at 40*s.* a tod	71	8	7
250 lambs, at 35*s.* each	437	10	0
200 ewes, at 70*s.*	700	0	0
Profit each year on selling 35 cows, at 3*l.*	105	0	0
Total	3413	18	7
Expense	1518	18	0
Profit	£1895	0	7

(Account 7.)

Expenses of the Land, &c.	£.	s.	d.	*Returns.*	£.	s.	d.
Rent of 400 acres, at 50*s*. an acre	1000	0	0	Profit on dairying - - -	1895	0	7
Assessments, at 6*s*. in the pound -	300	0	0	Profit on tillage-land - -	77	18	9
Taxes, according to the stock -	100	0	0				
Interest of capital laid out in buying stock, &c. as in account 1. 3523*l*. 8*s*. 6*d*. at 8 per cent. -	281	17	6				
	£1681	17	6	Total	£1972	19	4
				Expense	1681	17	6
				Total Profit	£291	1	10

Farm under the Hay-selling System.

In this case, it is stated that the stock consists of four cows, twelve horses, and six pigs:—all in the state of meadow, with the exception of twenty acres in pasture, and thirty under tillage.

Expenses of Stock, &c. (Account 8.)

	£.	s.	d.		£.	s.	d.
Purchase of 12 horses, at 20*l*. each	240	0	0	Brought forward	506	7	6
4 Cows, at 20*l*. - - -	80	0	0	A roller - - - - -	5	5	0
6 Pigs, at 20*s*. - - -	6	0	0	A wheelbarrow - - -	1	1	0
3 Waggons, at 30*l*. - -	90	0	0	A machine for dressing corn -	15	15	0
3 Carts, at 17*l*. - - -	51	0	0	Spades, shovels, forks, scuttles, measures, &c. - - - -	10	0	0
2 Ploughs, at 5*l*. 5*s*. - -	10	10	0	Harness for horses, at 3*l*. each -	36	0	0
2 Pair of harrows - - -	13	2	6	Household furniture - -	200	0	0
A scarifier - - -	15	15	0				
Carried forward	£506	7	6	Total	£774	8	6

(Account 9.)

Expenses on Land and Stock.	£.	s.	d.	*Returns.*	£.	s.	d.
Harvesting hay, 350 acres, at 20*s*. each	350	0	0	700 loads of hay (a proportion of two loads an acre), at 65*s*. a load -	2275	0	0
Preparing hay for the market -	78	15	0	After-crop of grass, at 20*s*. an acre	350	0	0
Three carters to drive the hay to market, at 20*s*. a week each - -	156	0	0	Profit on four cows - -	20	0	0
Three servant-boys, at 7*l*. 7*s*. a year each - - - - -	22	1	0	Ditto on the tillage-land - -	77	18	0
Turnpikes during the year - -	45	15	0	Wheat-straw on ten acres, five loads an acre, at 45*s*. per load - -	112	10	0
A servant-girl - - - -	6	0	0				
Expenses on the tillage-land, as in account 3, 61*l*. 5*s*. and 27*l*. 6*s*. 3*d*.	88	11	3				
Rent, the same as before - -	1000	0	0				
Assessments, at 6*s*. in the pound -	300	0	0				
Taxes - - - - -	50	0	0				
Interest of capital laid out in buying stock, &c. as in account 8, 774*l*. 8*s*. at 8 per cent. - - -	61	19	0				
800 loads of dung, at 2*s*. a load -	80	0	0				
	£2239	1	3	Total	£2835	8	9
				Expense	2239	1	3
				Profit	£596	7	6

Farm under Tillage, near a large Town.

In this case, the writer supposes the stock to consist of twelve horses for marketing, and six to plough the ground. And of the land 264 acres in tillage; thirty-six in meadow:—the remaining 100 acres grazed with oxen, being stocked with them in the proportion of three oxen to four acres;—also six milch cows; and 100 ewes, one to an acre, to produce lambs: the produce about 125 lambs; of course fresh stock will be wanted annually. The oxen must be bought in, in the spring season, at about twenty-five pounds each, being sold out at about thirty pounds. The fattened lambs, when sold, fetching about thirty-five shillings each. The ewes being purchased in at about forty-five shillings each; and disposed of at about seventy-five shillings each; being fattened on rape or turnips, put in on the land, from which the garden peas had been taken. And from the thirty-six acres of meadow land, the hay, from the situation of the farm, can, it is supposed, be sent to the market with more advantage than by consuming it; there being two loads to the acre; the eddish being eaten off by the sheep and oxen.

Expenses of Stock, &c. (Account 1).

	£.	s.	d.
Purchase of 70 oxen, at 25*l.* each	1750	0	0
100 ewes, at 45*s.*	225	0	0
	1975	0	0
12 Horses, at 25*l.*	300	0	0
6 ditto, at 15*l.*	90	0	0
6 Cows, at 20*l.*	120	0	0
A ram	5	0	0
8 Pigs, at 30*s.*	12	0	0
3 Waggons, at 30*l.*	90	0	0
3 Carts, at 17*l.*	51	0	0
Carried forward	£2643	0	0

	£.	s.	d.
Brought forward	2643	0	0
3 Ploughs, at 5*l.* 5*s.*	15	15	0
4 Pair of harrows	26	5	0
A scarifier	15	15	0
A roller	5	5	0
2 wheelbarrows	2	2	0
A machine for dressing corn	15	15	0
Spades, shovels, forks, scuttles, measures, &c.	10	0	0
Harness for horses, at 3*l.* each	54	0	0
Household furniture	200	0	0
Total	£2987	17	0

Stock. (Account 2.)

Expenses.

	£.	s.	d.
Purchase of stock, as in the first part of account 1	1975	0	0
—— of ten oxen to eat eddish in the autumn, at 25*l.* each	250	0	0
Wages of four men-servants	40	0	0
—— of two servant-girls	12	0	0
Clipping the sheep and sundries	2	0	0
Mowing and grubbing thistles on the grazing land, at 6*d.* per acre	2	10	0
Housekeeping	300	0	0
Clothing for family	50	0	0
The farmer's expenses in doing the business	70	0	0
Harvesting thirty-six acres of hay, at 10*s.* an acre	18	0	0
Total	£2719	10	0

Returns.

	£.	s.	d.
Sale of seventy oxen, at 30*l.* each	2100	0	0
—— of 100 ewes, at 75*s.*	375	0	0
—— of wool, 17 tods, at 40*s.* a tod	34	0	0
—— of 125 lambs, at 35*s.* each	218	0	0
—— of ten oxen, at 30*l.*	300	0	0
Profit on a cow and calf sold	3	0	0
—— on six cows	30	0	0
Total	£3060	15	0
Expense	2719	10	0
Profit	£341	5	0

It is observed by the writer, that he has estimated the expense of making the hay at ten shillings only the acre, as from the quantity being so small (thirty-six acres), the farmer may be supposed to do the work wholly in his own family: but when the work must be hired, twenty shillings may, he thinks, be little enough.

The tillage part of the farm is to be managed under a course of cropping, which affords fourteen crops during eleven years, being somewhat in the following manner:

Courses of Crops.

1st. Year, Potatoes manured for with 12 loads of dung per acre.
2d. —— Wheat, limed with 30 bushels, mixed with earth, per acre.
3d. Year, Flax; rape being sown after it is off, for seed
4th. —— Rape for a crop, straw burnt after it is taken off, for wheat
5th. —— Wheat.
6th. —— Garden peas drilled, and manured with four loads of dung per acre, and turnips afterwards; eight loads of dung per acre broad-casted, and drilled.
7th. —— Barley sown with clover.
8th. —— Clover, manured with six loads of compost per acre.
9th. —— Wheat; limed with thirty bushels mixed with earth per acre.
10th. —— Beans, manured with twelve loads of dung per acre, and hoed.
11th. —— Oats.

(Account 3.)

Dr. to Expenses.	£.	s.	d.	*Cr. by Produce.*	£.	s.	d.
Vetches, Eight Acres.							
Ploughing, at half-a-guinea an acre	4	4	0	Crop, at 7*l.* an acre - -	56	0	0
Seed, four bushels an acre, at 10*s.* a bushel	16	0	0				
Harrowing, at 1*s.* 6*d.* an acre -	0	12	0				
Manure, twelve loads an acre, at 10*s.* a load - - -	48	0	0				
	68	16	0		56	0	0
Turnips, Eight Acres, the same land.							
Scarifying, harrowing, and gathering refuse stuff, at 5*s.* an acre -	2	0	0	Crop, at acre - -	40	0	0
Ploughing, at half-a-guinea an acre -	4	4	0				
Seed, 6lb. an acre, at 9*d.* a pound -	1	16	0				
Harvesting, at 1*s.* 6*d.* an acre -	0	12	0				
Harrowing, when growing, at 1*s.* an acre - - -	0	8	0				
Hoeing, at 6*s.* an acre - -	2	8	0				
Rent of these eight acres - -	20	0	0				
Assessments, at 6*s.* in the pound -	6	0	0				
	37	8	0		40	0	0
Potatoes, Sixteen Acres.							
Ploughing twice, at half-a-guinea an acre each time - - -	16	16	0	Crop, 450 bushels an acre, at 1*s.* 6*d.* a bushel - - -	540	0	0
Scarifying, harrowing, and gathering refuse stuff, &c. at 5*s.* an acre -	4	0	0				
Manure, twelve loads an acre, at 10*s.* per load - - -	96	0	0				
Seed, thirty-six bushels an acre, at 1*s.* 6*d.* a bushel - - -	43	0	0				
Ploughing for planting, at half-a-guinea an acre - - -	8	8	0				
Carried forward	£275	8	0	Carried forward	£636	0	0

	£.	s.	d.		£.	s.	d.
Brought forward	275	8	0	Brought forward	636	0	0
Harrowing, when the crop comes up, at 1s. an acre - - -	0	16	0				
Hoeing, at 6s. an acre - -	4	16	0				
Ploughing up the crop, sowing wheat, and gathering the potatoes, at 50s. an acre - - -	40	0	0				
Rent - - -	40	0	0				
Assessments, at 6s. in the pound -	12	0	0				
	266	0	0		540	0	0

Wheat, Twenty-four Acres.

	£.	s.	d.		£.	s.	d.
Seed, 3½ bushels an acre, at 9s. 6d. a bushel - - -	39	0	0	Crop, five quarters an acre, at 76s. a quarter - - -	456	0	0
Harrowing, at 1s. 6d. an acre -	1	16	0	Straw, five loads an acre, at 45s. a load	270	0	0
Lime, thirty bushels an acre, bought at 4d. a bushel, mixing with earth, leading, &c. at 4d. a bushel -	24	0	0				
Bush-harrowing, and rolling, at 2s. 6d. an acre - -	3	0	0				
Weeding, at 6s. an acre - -	0	12	0				
Harvesting, at 18s. an acre -	21	12	0				
Threshing five quarters an acre, and tying the straw up, at 3s. a quarter	18	0	0				
Rent - - -	60	0	0				
Assessments, at 6s. in the pound -	18	0	0				
	186	18	0		726	0	0

Flax, Twenty-four Acres.

	£.	s.	d.		£.	s.	d.
Ploughing, at half-a-guinea an acre	12	12	0	Crop, 1028 stone of flax, at 14s. a stone	719	12	0
Seed, two bushels an acre, at 12s. 6d. a bushel - - -	30	0	0				
Harrowing and rolling, at 2s. 6d. an acre	3	0	0				
Weeding, at 2s. an acre - -	2	8	0				
Pulling, at 10s. 6d. an acre -	12	12	0				
Watering - - -	12	0	0				
Laying on the ledge, and taking up	12	0	0				
Beetling - - -	20	0	0				
Scutching twice, 1028 stone, at 2s. a stone	102	16	0				
Hackling ditto, at 3s. 6d. a stone -	179	18	0				
	387	6	0		719	0	0

Rapes for Seed, Twenty-four Acres, the same Land.

	£.	s.	d.		£.	s.	d.
Ploughing, at 10s. 6d. an acre -	12	12	0	Crop, five quarters of seed an acre, at 4l. a quarter - -	480	0	0
Seed, half a peck an acre, at 1s. 3d. a half peck - - -	1	10	0				
Harrowing, at 1s. 6d. an acre -	1	16	0				
Harvesting, threshing, &c. at 25s. an acre - - -	30	0	0				
Rent - - -	60	0	0				
Assessments, at 6s. in the pound -	18	0	0				
	£123	18	0		£480	0	0

Dr. to Expenses. — *Cr. by Produce.*

Wheat, Twenty-four Acres.

Dr. to Expenses.	£.	s.	d.
Burning rape-straw, at 20*s.* an acre	24	0	0
Ploughing, at 10*s.* 6*d* an acre -	12	12	0
Seed, $3\frac{1}{2}$ bushels an acre, at 9*s.* 6*d.* a bushel - - -	39	18	0
Harrowing, at 1*s.* 6*d.* an acre -	1	16	0
Bush-harrowing and rolling, at 2*s.* 6*d.* an acre - - -	3	0	0
Weeding, at 6*d.* an acre -	0	12	0
Harvesting, at 18*s.* an acre -	21	12	0
Threshing, five quarters an acre, and tying the straw up, at 3*s.* a quarter	18	0	0
Rent - - - -	60	0	0
Assessments, at 6*s.* in the pound -	18	0	0
	199	10	0

Cr. by Produce.	£.	s.	d.
Crop, five quarters an acre, at 76*s.* a quarter - - - -	456	0	0
Straw, five loads an acre, at 45*s.* a load	270	0	0
	726	0	0

Garden Peas, Twenty-four Acres.

Dr. to Expenses.	£.	s.	d.
Making drills, at 10*s.* 6*d.* an acre -	12	12	0
Manure, four loads an acre, at 10*s.* per load - - -	48	0	0
Seed, three bushels an acre, at 10*s.* a bushel - - -	36	0	0
Earthing, three times, at 2*s.* 6*d.* an acre each time - - -	9	0	0
Roguing, at 1*s.* an acre - -	1	4	0
Reaping, at 12*s.* an acre -	14	8	0
Threshing, five quarters an acre, at 1*s.* 3*d.* a quarter - -	7	10	0
	128	14	0

Cr. by Produce.	£.	s.	d.
Crop, five quarters an acre, at 4*l.* a quarter - - -	480	0	0
Straw, five loads an acre, at 30*s.* a load	180	0	0
	660	0	0

Turinps, Twenty-four Acres, same Land.

Dr. to Expenses.	£.	s.	d.
Scarifying, harrowing, and preparing the land for the crop, at 5*s.* an acre -	6	0	0
Ploughing and harrowing, at 12*s.* an acre - - -	14	8	0
Seed, 6lb. an acre, at 9*d.* a pound -	5	8	0
Harrowing the crop when growing, at 1*s.* an acre - - -	7	4	0
Rent - - -	60	0	0
Assessments, at 6*s.* in the pound -	18	0	0
	112	4	0

Cr. by Produce.	£.	s.	d.
Crop, at 5*l.* an acre - -	120	0	0
	120	0	0

Barley, Twenty-four Acres.

Dr. to Expenses.	£.	s.	d.
Ploughing, at 10*s.* 6*d.* an acre -	12	12	0
Seed, four bushels and a half an acre, at 4*s.* a bushel - -	21	12	0
Harrowing, at 1*s.* 6*d.* an acre -	1	16	0
Clover-seed, 20lb. an acre, at 8*d.* pound	16	0	0
Bush-harrowing and rolling, at 2*s.* 6*d.* an acre - - -	3	0	0
Carried forward	£55	0	0

Cr. by Produce.	£.	s.	d.
Crop, six quarters an acre, at 32*s.* per quarter - - -	230	0	0
Straw, five loads an acre, at 30*s.* a load	180	0	0
Carried forward	£410	8	0

Dr. to Expenses.	£.	s.	d.	*Cr. by Produce.*	£.	s.	d.
Brought forward	55	0	0	Brought forward	410	8	0
Weeding, at 6*d.* an acre -	0	12	0				
Harvesting, at 12*s.* an acre -	14	8	0				
Threshing, six quarters an acre, and tying the straw up, at 2*s.* 6*d.* a quarter	18	0	0				
Rent - - -	60	0	0				
Assessments, at 6*s.* in the pound -	18	0	0				
	166	0	0		410	8	0

Clover, Twenty-four Acres.

	£.	s.	d.		£.	s.	d.
Manure, six loads an acre, at 10*s.* a load - - -	72	0	0	Crop, 3½ loads of hay an acre, at 5*l.* a load - - -	420	0	0
Mowing twice, at 2*s.* 3*d.* an acre each time - - -	5	8	0				
Harvesting, at 3*s.* 6*d.* an acre -	4	4	0				
Rent - - -	60	0	0				
Assessments, at 6*s.* in the pound -	18	0	0				
	159	12	0		420	0	0

Wheat, Twenty-four Acres.

	£.	s.	d.		£.	s.	d.
Ploughing, at 10*s.* 6*d.* an acre -	12	12	0	Crop, five quarters an acre, at 76*s.* a quarter - - -	456	0	0
Seed, 3½ bushels an acre, at 9*s.* 6*d.* a bushel - - -	39	18	0	Straw, five loads an acre, at 45*s.* a load	270	0	0
Harrowing, at 1*s.* 6*d.* an acre -	1	16	0				
Lime, fifty bushels an acre, bought at 4*d.* a bushel, mixing earth, leading, &c. at 4*d.* a bushel - -	24	0	0				
Bush-harrowing and rolling, at 2*s.* 6*d.* an acre - - -	3	0	0				
Weeding, at 6*d.* an acre - -	0	12	0				
Harvesting, at 18*s.* an acre -	21	12	0				
Threshing, five quarters an acre, and tying the straw up, at 3*s.* a quarter	18	0	0				
Rent - - -	60	0	0				
Assessments, at 6*s.* in the pound -	18	0	0				
	199	10	0		726	0	0

Beans, Twenty-four Acres.

	£.	s.	d.		£.	s.	d.
Manure, twelve loads an acre, at 10*s.* a load - - -	144	0	0	Crop, five quarters an acre, at 35*s.* a quarter - - -	210	0	0
Ploughing, at 10*s.* 6*d.* an acre -	12	12	0	Straw, five loads an acre, at 30*s.* a load	180	0	0
Seed, three bushels an acre, at 4*s.* 4½*d.* a bushel - - -	15	15	0				
Harrowing, at 1*s.* 6*d.* an acre -	1	16	0				
Hoeing, at 6*s.* an acre - -	7	4	0				
Threshing five quarters an acre, at 2*s.* a quarter - - -	21	12	0				
Rent - - -	60	0	0				
Assessments, at 6*s.* in the pound -	18	0	0				
	£292	19	0		£390	0	0

Dr. to Expenses.

Oats, Twenty-four Acres.

	£.	s.	d.
Ploughing, at 10*s*. 6*d*. an acre -	12	12	0
Seed, eight bushels an acre, at 4*s*. a bushel - - -	38	8	0
Harrowing, at 1*s*. 6*d*. an acre -	1	16	0
Bush-harrowing and rolling, at 2*s*. 6*d*. an acre - - -	3	0	0
Weeding, 6*d*. an acre - -	0	12	0
Harvesting, at 12*s*. an acre -	14	8	0
Threshing, ten quarters an acre, and tying the straw, at 2*s*. a quarter -	24	0	0
Rent - - -	60	0	0
Assessments, at 6*s*. in the pound -	18	0	0
Total	£2501	11	0

Cr. by Produce.

	£.	s.	d.
Crop, ten quarters an acre, at 32*s*. a quarter - - -	384	0	0
Straw, five loads an acre, at 30*s*. a load	180	0	0
	564	0	0
Total	£6578	0	0
Expense	2501	11	0
Profit	£4076	9	0

(Account 4.)

Expenses of the Land.

	£.	s.	d.
Rent for 136 acres of grass-land, at 50*s*. an acre - - -	340	0	0
Assessments, at 6*s*. in the pound -	102	0	0
Taxes - - -	170	0	0
Interest of capital laid out in buying stock, &c. 2987*l*. 17*s*. at 8 per cent.	239	0	7
Total	£851	0	7

Returns.

	£.	s.	d.
Profit on 136 acres of grass-land, as in account 2 - -	341	5	0
—— on 264 acres of tillage-land, as in account 3 - -	4076	9	0
Total	£4417	14	0
Expense	851	0	7
Profit	£3556	13	5

Farm under Tillage, more remotely situated.

It is supposed to be similar in all respects to the other, except in point of situation, which renders the hay and straw necessary to be consumed upon the farm. Of course, the calculations show the differences in the value or advantages of different situations. And it is supposed that, as before, 264 acres of the land are in tillage; 36 in the state of meadow; and the remaining 100 in pasture. The stock for the last porton; oxen, as before, 70; ewes, one to the acre, 100: he supposes these latter to afford 125 lambs; these to be sent to the market; and the ewes to be fattened on the rape soon after rearing the peas. On these articles, the profit is explained in account 2: oxen, 5*l*. each, profit; the lambs, 3 5*s*. each: ewes bought at 45*s*., and sold at 75*s*.; going off when mutton is dear in winter. Horses, ten only, as fewer will do, there being nothing but the corn to take to market; but more oxen must be kept. These bought in the summer, to be fed on straw in the winter: four or six being used for carting dung, harvest-work, &c. A larger stock of pigs may also be kept; fifty being put in the fold-yard. And as in this case the clover-hay is to be eaten, the oxen may have some in the spring in the yard, to forward them for fattening off in the pastures. Of course, there is no profit in the hay, but from the oxen. Six of the horses to be sold annually, and others bought in. The oxen purchased in, in the summer, as there may be room; 88 being annually provided and fattened, so as to have a fresh stock every season: 18 being fattened in winter, and 70 in summer.

Expenses of Stock, &c. (*Account* 1).

	£.	s.	d.
Purchase of 70 oxen, at 20*l.* each (being bought in the summer, and wintered at straw) - -	1400	0	0
100 Ewes, at 45*s.* - -	225	0	0
	£.1625	0	0
10 Horses, at 25*l.* - -	250	0	0
6 Cows, at 20*l.* - - -	120	0	0
A Ram, at 5*l.* - -	5	0	0
8 Pigs, at 30*s.* - -	12	0	0
2 Waggons, at 30*l.* - -	60	0	0
Carried forward	£2012	0	0

	£.	s.	d.
Brought forward	£2012	0	0
2 Carts, at 17*l.* - -	34	0	0
3 Ploughs, at 5*l.* 5*s.* - -	15	15	0
4 Pair of harrows - -	26	5	0
A scarifier - - -	15	15	0
A roller - - -	5	5	0
2 wheelbarrows - -	2	2	0
A machine to dress corn - -	15	15	0
Shovels, spades, forks, scuttles, measures, &c. - -	10	0	0
Harness for 10 horses, at 3*l.* each -	30	0	0
Household furniture - -	200	0	0
	£.2426	17	0

Grass-Land. (*Account* 2.)

Stock Expenses, &c.

	£.	s.	d.
Purchase of stock, as in the first part of account 1 - -	1625	0	0
18 oxen to eat hay in the winter, at 20*l.* each - - - -	360	0	0
Clipping the sheep, and sundries -	2	0	0
50 pigs, at 30*s.* each - -	75	0	0
Mowing and grubbing thistles on the pasture-land, at 6*d.* an acre -	2	10	0
Harvesting thirty-six acres of hay, at 10*s.* an acre - -	18	0	0
Rent of 136 acres, at 50*s.* -	340	0	0
Assessments, at 6*s.* in the pound -	102	0	0
Total	£2524	10	0

Returns.

	£.	s.	d.
Sale of 70 oxen, at 30*l.* each -	2100	0	0
—— of wool, 17 tods 24lb. at 40*s.* a tod - - -	35	14	3
—— of 100 ewes, at 75*s.* -	375	0	0
—— of 125 lambs, at 35*s.* -	218	15	0
—— of 18 oxen, at 30*l.* - -	540	0	0
Profit on a cow and calf sold -	3	0	0
—— on 6 cows sold - -	30	0	0
—— on 6 horses sold - -	30	0	0
50 pigs sold, at 55*s.* each -	137	0	0
Total	£3469	19	3
Expense	2524	10	0
Profit	£915	9	3

It is observed that, by a trifling mistake in most of the above statements, the house-keeping and expenses have been put into one of the separate accounts, instead of the general account, at the end of each farm; and in the same manner, the rent charged in account 4, should have been brought into account 5; but these are of little consequence, as the sums of *total profit* must have been the same.

The tillage in this case is under the same courses as in the preceding farm.

(*Account* 3.)

Expenses.

	£.	s.	d.
Vetches and turnips - -	106	4	0
Potatoes - - -	266	0	0
Wheat - - -	186	18	0
Flax - - -	387	6	0
Rape, for seed - -	123	18	0
Wheat - - -	199	10	0
Garden peas - - -	128	14	0
Carried forward	£1398	10	0

Produce.

			£.	s.	d.
Crops of vetches - -			56	0	0
—— of turnips - -			40	0	0
Crop - - -			540	0	0
Crop - - -	456	0			
Straw, at 30*s.* an acre* -	36	0			
			492	0	0
Carried forward			£1128	0	0

* Though all the straw and clover be consumed by the horses, cattle, &c on the farm; yet, as the ploughing, harrowing, manuring, &c. of the crops are charged at the full price, it is necessary that in this account a fair rate should be allowed for the whole of the produce.

	£.	s.	d.
Brought forward	£1398	10	0
Turnips - - -	112	4	0
Barley - - -	166	0	0
Clover - - -	159	12	0
Wheat - -	199	10	0
Beans - - -	292	19	0
Oats - - -	172	16	0
Total	£2501	11	0

			£.	s.	d.
Brought forward			1128	10	0
Crop - - -			719	12	0
Crop - - -			480	0	0
Crop - -	456	0			
Straw, at 30*s.* per acre -	36	0			
			492	0	0
Crop - -	480	0			
Straw, at 30*s.* per acre -	36	0			
			516	0	0
Crop - - -			120	0	0
Crop - -	230	8			
Straw, at 30*s.* per acre -	36	0			
			266	8	0
Crop, at 2*l.* 10*s.* per load -			210	0	0
Crop - -	456	0			
Straw, at 30*s.* per acre -	36	0			
			492	0	0
Crop - -	210	0			
Straw, at 30*s.* per acre -	36	0			
			246	0	0
Crop - -	384	0			
Straw, at 30*s.* per acre -	36	0			
			420	0	0
Total			£5090	0	0
Expense			2501	11	0
Profit			£2588	9	0

(Account 4.)

Expense of the Land, &c.

	£.	s.	d.
Taxes, according to the stock -	130	0	0
Interest of capital laid out in buying stock, &c. 2426*l.* 17*s.* at 8 per cent.	194	2	11
4 men-servants - -	40	0	0
2 servant-girls - -	12	0	0
Housekeeping - -	300	0	0
Clothing for family - -	50	0	0
Farmer's expenses in doing the business	70	0	0
Total	£796	2	11

Returns.

	£.	s.	d.
Profit on the grass-land, 136 acres	945	9	3
—— on the arable-land, 264 acres	2588	9	0
Total	£3533	18	3
Expense	796	2	11
Total Profit	£2737	15	4

It is remarked on these different methods of husbandry, that, from these statements, it is shown by calculation that the *annual* profit on *one acre* of land by each of the modes, is in the proportion as below:

	£.	s.	d.
On the *Grazing farm* - - -	0	6	6
——— *Dairy-farm* - - -	0	14	6
——— *Hay-farm* - - -	1	9	9
——— *Tillage-farm*, 1st situation	8	17	10
——— *Tillage-farm*, 2d situation	6	17	0

It is suggested that, in both the systems of management, on the tillage farm, there are twelve horses made use of for the purpose of market business, and bringing back what may be wanted, and six of a lighter kind for the purpose of ploughing; which may be provided at much less expense than the others, and do a larger proportion of work in an equal time.

And, by the improved course of cropping made use of, it is stated, that there will never be more than twenty-four acres to dung at any one time, except at the wheat-sowing season; and then even the quantity may be divided; by that part of the land, which has grown the potatoes, being sown first at the time that root is taken up. By pulling up all the tops or stems, and depositing them in the farm-yards as lit-

ter, these, and the portion of earth that is taken along with them, will be returned to the land. Any small potatoes being made use of for the pigs. And, by sowing the wheat immediately on the land cleared from the tops of the potatoes, before the potatoes are ploughed up, advantage is suggested to be gained.

From the danger of frost, more of the tops should not be cleared at once than can be ploughed up in the course of the day.

In pursuing this plan, the next sowing of wheat will be, it is said, on the land that has grown rape for seed. And it may be sown first, when the potatoes are not ready to be taken up. And the third time of sowing wheat will be on the clover-hay; in which cases there is plenty of time, as it may be done in the winter with almost equal success from September to January. But this is not the case with spring crops, as all these of the grain kind should be put in as quickly as possible. The bean and pea crops may always be, however, placed in the ground a fortnight or three weeks before those of the corn kind; and it is suggested, that where the ground is all ready, and the teams are taken off for the purpose, there will be nine pair of horses which will be capable of harrowing in the whole of these crops in three days. And the twenty-four acres of barley, and twenty-four acres of wheat, may be harrowed in in three days more. This is supposed one great benefit resulting from large teams, as from such a number being made use of in conveying the produce, they may be employed probably for about twenty days in seed-time and harvest, and thereby made to earn nearly what they cost in keep during the whole year.

There are likewise other benefits, it is supposed, resulting from this plan of cropping; the harvest work is more divided; the flax and peas are ready in July: then the oats before the wheat; and the wheat before the bean-crop. This not only affords convenience, but at the same time lessens expense. The rape-seed may be threshed in the field, and disposed of early in August, and thus furnish the farmer with money for the expenses of the other harvest. And there is scarcely a month in the year, that he has not a good sum of money coming in from some or other of the processes. The flax may be sold on the ground to pull by the buyer in July, producing from seven to nine guineas the acre; which, though it appears a small sum when compared with some other crops, is said to pay well for the time it is upon the ground, which is only about three months, being sown in April, and pulled in July. These are all great advantages, by which the expenses are lessened, and consequently larger profits obtained.

In fact, these statements afford the farmer the means of judging of the most proper way of employing his land, in order to obtain the largest profit. They show three of the modes of farming to be in different concerns, and that the tillage-husbandry has greatly the advantage; and the writer supposes that many improvements in it are still capable of being made; for which he has thrown out a variety of useful hints and suggestions, supported by hints and calculations, as may be seen in his work.

It is, however, to be constantly kept in mind, that in all the different methods of husbandry, the profits or advantages must arise, not only from the excellence of the management that may be pursued, but from the nature of the situation, in respect to the mode of stocking the land, and that of cultivating it; as in some districts, the expense of the former per acre will not be more than from five to seven or eight pounds; while, in others, it may be from ten to twelve or thirteen pounds the acre; as is the case in many parts of Essex, and of course the expenses in an equal ratio or proportion, though the differences in the markets for disposing of the produce may not be very material.

The farm, of which the following is the account, is supposed to contain 100 acres of land of the arable kind, and ten acres of old pasture; being situated in the centre of *good roads* and *market towns*. And the calculations are formed on the supposition of the land being upon a good corn clay bottom, too wet to grow turnips, except a few for *spring* feed; but in a state of perfect good order and tillage. The profit, it is suggested, appears large in the account; but it is to be remembered, that, before the farm is brought into this state, *four* years of the lease must probably elapse, and additional capital be sunk, which is difficult to calculate. As the farm is in Essex, the chief improvement is by land-ditching, or hollow draining, to remove the surface water; and by claying or marling, chalking or liming, when within the reach of the last articles.

The expense of these improvements are shown at the end of the account. The produce of the farm is stated rather high, but not beyond the average produce of good farms, in a high state of tillage cultivation, nor is the price of grain set over high. The profit of live-stock is low; but allowance is made for casualties.

The mode of management is supposed to be this: half the ten acres of pasture to be mown every year; the part fed one year to be mown the next, and so on every succeeding year, as they will both share alike from feeding. Twenty-five acres of fallow to be made every year; five of which to be sown with turnips, ten with tares (before fallow is made) upon that portion intended for fallow, to be fed off in proper time, which may easily be done by sowing the tares immediately after harvest.

One fourth, or twenty-five acres, to be sown with soft corn; one fourth, or twenty-five acres, with wheat; one eighth, or $12\frac{1}{2}$ acres, with beans and peas; there will then remain an eighth, or $12\frac{1}{2}$ acres of clover. In this succession of crops, $12\frac{1}{2}$ acres, or an eighth part of the farm, will come in course for clover every eighth year, which will allow $12\frac{1}{2}$ every year, which should not be mown more than once.

At the close of the general account, the balance of the stock account or profit is shown. It may be supposed, that too much green food is charged to the stock, but it is believed it will be consumed as it comes to be fed. The five acres of turnips for four cows,

sixty ewes and lambs, besides breeding sows and pigs, will not last long: when these are off, they have only the resource of the ten acres of pasture, which should be in good order for feed, and be capable of maintaining the sheep and cows with hay, till the ten acres of tares are ready, as by May-day; these being cleared off the land, before the after-crop of clover become fit for stocking. It is suggested, that hogs are great devourers of tares, and much waste made by trampling, more so than on any other feed, from their juicy and tender quality. Little can be charged to horses, for their feed in the after-crop of clover, much depends upon season. Some green food will be necessary for horses, which they may have with the other stock on the $12\frac{1}{2}$ acres of after-clover, which must be charged to their account. Some lambs will now be drawn for the butcher, of course make the feed hold out longer during harvest: then the ten acres of pasture, *half* after-crop, the other feed being the only keeping for general stock during the winter season.

It is observed, that improving land by chalking is expensive in the first instance, but pays the farmer well. Its benefit is most evident upon the strong loamy soils of Essex. The expense per acre as below:

Eight waggon-loads per acre, of two chaldrons each, or sixteen per acre, at 7*s.* when carried three or four miles; horses and men's time, as much as the chalk.

Claying more generally employed in the inland parts, and found nearly as lasting and serviceable as chalk on some lands, being more adapted to its improvement; as white binding soils and hollow bottoms. There should not be less than eighty carts and three-quarters, or one hundred carts and an half, or sixty chaldrons tunbrill loads. Three-quarter carts with broad wheels mostly employed for this business, at 5*s.* per score, including beer, filling, and spreading: two men fill one score per day: after the horses are gone home, the same men spread it.

The land-ditching is done at different prices, from 2*s.* 6*d.* per score rods to 6*s.* including beer, supposing the land forty rods long and one rod wide, which will make four furrows upon an acre: if drawn out by a proper land-ditch plan, will be done at 2*s.* 6*d.* per score, exclusive of wood, bushes, or stone. Eighty spray faggots, or a load and half, at 1*l.* 1*s.* per load delivered in, making 1*l.* 8*s.* per acre for wood: four furrows, forty rods long each, or 160 rods, or eight score multiplied by 2*s.* 6*d.* make 1*l.* 0*s.*; that added to 1*l.* 8*s.* will amount to 2*l.* 8*s.* per acre. Hazle usually found on the spot, which, when good, answers equally with straw; bushes differ little in price from wood. Stones better in all respects, being durable and not so liable to blow, but not met with on all lands; one load of stones of sixteen bushels does twelve rods.

It is suggested, that the balance of the general farming account is tollerable, when the deductions of rent, property tax, and a few others, are made.

These estimates are stated to be from an intelligent cultivator, in the district about Felix-hall, in the above county.

General Expenses in Stocking a Farm, and Charges of one Year: Time of Hiring at Michaelmas.

ACCOUNT 1.

	£.	s.	d.
5 Horses, 30*l.* each	150	0	0
4 Cows, 12*l.* each	48	0	0
30 Ewe sheep, 30*s.* each	45	0	0
20 Pigs, 20*s* each	20	0	0
4 Sows, 50*s.* each	10	0	0
Poultry of sorts	3	0	0
2 Waggons, 36*l.* each	72	0	0
3 Three-quarter chaldron carts, 14*l.* each	42	0	0
2 Foot ploughs, with iron breasts, complete, 4*l.* 6*s.*	8	12	0
1 Set of heavy harrows, complete, 5 to the set	6	10	0
1 Ditto for wheat-seeding	5	10	0
1 Ditto light, for spring corn	4	4	0
Whipple-trees for ditto; long ones at 6*d.* per foot; short ones, 1*s.* each	0	12	0
1 Heavy roller, complete	5	5	0
1 Light ditto, ditto	2	15	0
1 Ridge roll ditto	1	12	0
5 Pair of plough chain-traces, weighing 7lb., at $8\frac{1}{2}$*d.* per pound	1	8	4
5 Ditto of plough seals and leathers, complete, at 4*s.*	1	0	0
5 Back-leathers, &c. complete, at 5*s.* 6*d.*	1	7	6
5 Plough-collars, 6*s.* each	1	10	0
5 Plough-halters, 8*s.* 6*d.* each	2	2	6
3 Ditto-lines, 1*s.* per pound	0	10	6
4 Pair of waggon-trace, weighing 20lbs. per pair, at $7\frac{1}{2}$*d.* per lb.	2	10	0
4 Back-leathers, &c. complete, 18*s.* each	3	12	0
4 Cruppers, and hip-strap to trace, at 12*s.*	2	8	0
4 Pair of waggon-seals, complete, 6*s.* 6*d.* each	1	6	0
5 Cart collars, 7*s.* 6*d.* each	1	17	6
5 Bit-halters for waggon and cart use, 10*s.* 6*d.* each	2	12	6
3 Thill-saddles, breechings, cruppers, &c. complete, at 2*l.* 10*s.* 6*d.* each	7	11	6
3 Ridge-ropes, weighing 6lb. each, $8\frac{1}{2}$*d.* per lb.	0	12	9
3 Pair of thill-bands, 13*s.* each, complete	1	19	0
2 Cart-ropes, 1*s.* per lb.	2	10	0
5 Leaders and legs, 6*s.* each	1	10	0
3 Belly-wanties, at 2*s.* 6*d.*	0	7	6
1 Long-whip for waggon use	0	7	0
4 Good cow-cribs, at 1*l.* 1*s.* each	4	4	0
50 Sacks, at 5*s.*	12	10	0
1 Bushel and strike	1	0	0
1 Corn skreen	3	0	0
Carried forward	£482	16	7

	£.	s.	d.
Brought forward	482	16	7
3 Fans, 9*d.* each	1	7	0
5 Sieves, 4*s.* each	1	0	0
3 Dung-forks, at 6*s.*	0	18	0
3 Iron shovels, at 5*s.*	0	15	0
3 Corn or casting ditto, at 4*s.*	0	12	0
6 Rakes	0	6	0
6 Harvest forks, at 3*s.* 6*d.*	1	1	0
4 Dew-rakes, 20*s.* each	4	0	0
1 Sack-barrow	1	11	6
1 Corn-bin	1	5	0
1 Long ladder, 36 staves, at 7*d.* per stave	1	1	0
1 Short ditto, 18 ditto, ditto	0	10	6
1 Leading ditto	1	1	0
40 Hurdles, 2*s.* 6*d.* each	5	0	0
Sundries	10	0	0
10 Loads of grass-hay allowed for, when taking the farm, at 3*l.* 10*s.* per load	35	0	0
20 Loads of clover-hay, allowed for upon the premises, in taking the farm	70	0	0
200 Loads of manure allowed for upon the premises, at 3*s.* 6*d.* per load	35	0	0
100 Loads of manure not carried out of the yard, at 2*s.*	10	0	0
12$\frac{1}{2}$ Acres of young clover, 14lbs. of seed per acre, at 1*s.* per lb. for seed, and 3*d.* per acre sowing, 14*s.* 3*d.*	8	19	6
25 Acres of fallow allowed to the out-going tenant, six ploughings, harrowing, rolling, and water-furrowing, at 10*s.* or 3*l.* per acre	75	0	0
Rent allowed to out-going tenant for 25 acres of fallow, at 1*l.* per acre	25	0	0
Tithe, great and small, 6*s.* per acre; parish rates 6*s.* or 12*s.* per acre allowed to out-going tenant for 25 acres of fallow	15	0	0
Threshing 25 acres of wheat for the out-going tenant, at 4*s.* per quarter, at three quarters per acre, the in-coming tenant having the straw and chaff	15	0	0
Ditto 25 acres of soft corn, at 2*s.* per quarter, at five quarters per acre	12	10	0
Ditto 12 acres of beans, at 1*s.* 3*d.* per quarter, at 4$\frac{1}{2}$ quarters per acre	3	10	0
Carried forward	£818	4	1

HUS

	£.	s.	d.
Brought forward	818	4	1
25 Acres of wheat sowed, at 10 pecks per acre, at 8*s.* 9*d.* per bushel, or 17*l.* 10*s.* per load of five quarters	27	6	10$\frac{1}{2}$
25 Acres of soft corn, at four bushels per acre, at 30*s.* per quarter	18	15	0
12$\frac{1}{2}$ Acres of beans, at two bushels per acre, at 32*s.* per quarter	5	0	0
12$\frac{1}{2}$ Acres of clover, at 14lbs. of seed per acre, at 1*s.* per lb.	8	15	0
5 Acres of turnips, at 1$\frac{1}{2}$ pint per acre, 9*d.* per pint	0	5	7$\frac{1}{2}$
5 Acres of ditto, bought of the out-going tenant	15	0	0
10 Acres of tares sowed, at three bushels per acre, at 7*s.* per bushel	10	10	0
1 Year's labour* for five men, harvest and hay-time included, at 36*l.* 12*s.* per man	185	0	0
1 Year's horse keep to five horses, 1$\frac{1}{2}$ bushel of corn each horse per week, at 4*s.* per bushel, is 6*s.* per head per week, which multiplied by five horses, is 30*s.* per week, or per annum	78	0	0
Half a truss of hay, weighing 56lb. or 28lb. of hay per day each horse, at 3*s.* 6*d.* per cwt. is 10$\frac{1}{2}$*d.*, which multiplied by seven days is 6*s.* 1$\frac{1}{2}$*d.* each horse, which multiplied by five horses, is 1*l.* 10*s.* 7$\frac{1}{2}$*d.* per week, or per annum	79	12	6
3 Corn-fansful of chaff each horse per week, at 6*s.* per fanful, is 1*s.* 6*d.* per head per week, which multiplied by five horses, is 7*s.* 6*d.* per week, or per annum	19	10	0
1 Year's poor-rate upon 110 acres, at 1*l.* per acre, he will suppose at 6*s.* per acre poor-rate	33	0	0
1 Year's great and small tithe, at 6*s.* per acre	33	0	0
Horse-duty, at 12*s.* each horse	3	0	0
Wear and tear, including farrier's bill	50	0	0
Sundries	20	0	0
Interest on capital, 1402*l.* 19*s.* 1*d.* or 1403*l.*	70	3	0
Total	£1475	2	1

* Labour is not estimated *too* high, as *harvest* and *hay-time*, and *hoeing*, are included. The expense and the mode of getting in the harvest, in this part of the county of Essex, and the number of acres to harvest, are as follow: viz.

25 Acres, wheat.
25 Ditto, of soft corn.
12$\frac{1}{2}$ Ditto, of beans.

62$\frac{1}{2}$

62$\frac{1}{2}$ acres to cut and cart, at 10*s.* 6*d.* per acre for five men, or twelve acres and a half per man, at 6*l.* 11*s.* 3*d.* per man, exclusive of beer, the allowance of which is four bushels of malt at a time, price at 10*s.* per bushel, which is 2*l.*; likewise 3lbs. of hops, at 1*s* 6*d.* per lb., 2*s.* for harvest-supper, if none is allowed at the master's house, extras he will suppose to be 5*s.* per man more, which will make 2*l.* 11*s.* 6*d.* in addition to 6*l.* 11*s.* 3*d.* which multiplied by five men, will make the whole harvest amount to 45*l.* 2*s.* 9*d.*

N. B. In some parts of the county of Essex, labour is considerably higher (particularly in the hundreds), perhaps *double* in the harvest; produce is *greater*, and poor-rates *less*.

Annual Expenses and Profits of Farm, as in Account 1.—Balance to be settled between Tenant and Landlord, as may be agreed for Rent—Property Tax not charged.

Dr.	£.	s.	d.
1 Year's labour of 5 men, at 36*l.* 12*s.* per man	183	0	0
1 Do. horse-keep of 5 horses, at 35*l.* 8*s.* 6*d.* chaff included	177	2	6
1 Do. horse-duty, at 12*s.* per horse	3	0	0
1 Do. poor-rates and tithes	66	0	0
1 Do. wear and tear	50	0	0
Seed, as described in account 1	70	12	6
Interest of capital employed, according to the sum total in account 1	70	3	0
Sundries	10	0	0
30 Ewes, at 30*s.* each	45	0	0
20 Pigs, at 20*s.*	20	0	0
Food for pigs and hogs	20	0	0
	£714	18	0
Balance for tenant and landlord	327	3	0
Total	£1042	1	0

Cr.	£.	s.	d.
25 Acres of wheat, produce 4 quarters per acre, at 3*l.* 10*s.* per quarter, or 17*l.* 10*s.* per load of 5 quarters	350	0	0
25 Do. soft corn, at 6½ quarters per acre, at 30*s.* per quarter	243	15	0
12½ Acres of beans, at 5 quarters per acre, at 32*s.*	96	19	0
12½ Do. clover for hay at 2 tons per acre, at 3*l.* 10*s.* per ton	87	10	0
Profit of 4 cows, at 10*l.* each	40	0	0
30 Ewes, at 40*s.*	60	0	0
30 Lambs, at 30*s.*	45	0	0
30 Fleeces of wool, weighing 4lbs. per fleece, at 1*s.* 6*d.* per lb.	9	0	0
20 Hogs, at 40*s.*	40	0	0
60 Pigs, part produce of 4 sows, at 20*s.*	60	0	0
Poultry, &c.	10	0	0
	£1042	1	0
	714	18	0
	£327	3	0

Account showing Profits of Live-Stock.

Stock Dr.	£.	s.	d
5 Acres of turnips, at 2*l.* 10*s.* per acre	12	10	0
5 Do. of grass hay, at 3*l.* 10*s.* per load, at 1½ load per acre	26	5	0
5 Do. of after-crop of grass, at 25*s.* per acre	6	5	0
10 Do. of tares, at 3*l.* 10*s.* per acre	35	0	0
5 Do. of grass-feeding the whole year	20	0	0
12½ Do. after-food of clover, at 15*s.*	9	7	6
Food for hogs and pigs, suppose	20	0	0
30 Ewe sheep, at 30*s.* each	45	0	0
20 Pigs, at 20*s.*	20	0	0
To balance	59	12	6
	£254	0	0

Cr.	£.	s.	d.
Produce of 4 cows	40	0	0
30 Ewe sheep, at 40*s.*	60	0	0
30 Lambs, at 30*s.*	45	0	0
30 Fleeces of wool, 4lbs. each, at 1*s.* 6*d.*	9	0	0
20 Hogs, at 40*s.*	40	0	0
60 Pigs, produce of 4 sows	60	0	0
	£254	0	0

That great improvements have been effected in the husbandry of the country within these few years, by the introduction of better modes of cropping, and the combining of cattle-stock, with that of tillage, as well as by greater attention to improved implements, and other points of farm management, there cannot be the least doubt. It is remarked by the writer of the corrected Report of the County of Norfolk, that at Hackford, in conversation with Mr. Bircham on the public benefit of tillage-husbandry, and the effect of landlords restraining their tenants from breaking up grass-land, "he asserted it as a fact, of which he had not the least doubt, that tillage, well managed, would support as much live-stock on the seeds, turnips, and straw, as the same land would do all under grass; consequently, the corn is all gain to the public. *He is certain it would:* he spoke of moderate pasture, that keeps two beasts of forty stone per acre in summer." And that "great improvements have taken place in Earsham hundred, in twenty years. The number of horses much lessened, by not ploughing so often for barley; scarifying instead of it, and even putting that crop in on one earth.—Mr. Paul, of Shar-

ston, has even trusted to scarifying only, and thus got the best barley on his farm. Besides this practice, general management is better; and far more weeding done than formerly." And "Mr. Thurtell is clear, that in five and twenty years past, the general average produce is, at least, one-fourth more, probably one-third." This is confirmed by Mr. Ferrier, of Hemsby, who "is sure, that in husbandry, there is great improvement in thirty years. The seeds were then left three years; and they did not raise half the corn that is produced now. Summer-fallows were common then; now, no such thing known, unless by chance, when no manure for turnips." Mr. Syble, of South Walsham, is also clear that husbandry is much improved of late years: summer-fallowing, heretofore so common, is quite done away, yet the land cleaner. Small trifling inclosures are thrown together, the hedges and pollards grubbed, and the sun and air admitted. Dibbling has spread very greatly." And "Mr. Palgrave, of Coltishal, has no doubt of the improvement that has taken place in seventeen years; every thing is better done, and business carried on with more animation: drilling is spreading, and dibbling increased." Nor has "Mr. Parmenter, of Aylesham, the least doubt of husbaudry being greatly improved: more land in cultivation, and a greater expense in manuring, and every other article bestowed." It is added, that "Mr. Styleman has improved his Ringstead farm from 5*s*. to 15*s*. an acre. A farm in Snettisham, which he has let, from 11*s*. in 1783, to 17*s*. in 1798; and has laid out, improved, built, and let seven farms, at a very considerable improvement; and this he considers as the most profitable object of a gentleman's husbandry. The writer viewed several of his new farms, and found the buildings on a rational scale; so small, yet convenient, that the expense was no formidable objection, even for small farms. And this gentleman has no doubt of the husbandry of the vicinity being much improved in twenty years, exclusive of new inclosures: the crops were then disfigured by weeds, but now, every man is ashamed to have such seen on his farm: drilling and dibbling have done much." Nor has Mr. Saffory, of Downham, any "doubt of husbandry being much improved in twenty years: they plough better, manure more, and have carried all rough banks and hills on to their fields." And "Mr. Hill thinks, that the husbandry around Waterden has wonderfully improved in the last fifteen years. He attributes it chiefly to drilling, and the various conversations which have taken place upon that topic. Another essential point is, the increase of sheep; cows much lessened, and, consequently, fewer turnips being drawn for them:"

But though much has evidently been accomplished by the adoption of new and improved methods of husbandry, in increasing the quantity and quality of different sorts of crops, in rendering live-stock much more valuable, and by the use of better and more convenient tools, in lessening the expenses of labour, consequently augmenting the profits in a high degree; still there is scarcely a district in the kingdom in which much is not yet wanted, or in which the produce is not capable of being increased to a very considerable extent by proper exertion, and the general application of those means of improvement, which modern practice has shown to be so beneficial. Let, says an experienced cultivator, "the legislature annul, or at least modify, those laws which press down the spirit of the farmer; let the proprietors grant leases on liberal terms and of moderate endurance, and establish judicious regulations in regard to modes of cropping and general management; and let them both, in their legislative and individual capacities, promote every measure calculated to disseminate useful knowledge respecting rural affairs; and the state of British husbandry twenty years hence will be greatly improved beyond what it is at present."

Husbandry, *Implements of.* See *Implements of Husbandry.*

Husbandry *Simivergillian*, a term applied to a sort of half-husbandry of a peculiar kind, practised and recommended by some of the ancient writers, as Virgil, &c.

HUSBANDMAN, a term applied to the labourer or person who tills or cultivates the ground or soil. The following curious but interesting comparison has been drawn between him and the artisan or mechanic by Dr. Adam Smith, in his Wealth of Nations, in the tenth chapter of the first book. He observes, that "not only the art of the farmer, the general direction of the operations of husbandry, but many inferior branches of labour, require much more skill and experience than the greater part of mechanic trades. The man who works upon brass and iron, works with instruments and upon materials of which the temper is always the same, or very nearly the same. But the man who ploughs the ground with a team of horses or oxen, works with instruments of which the health, strength, and temper, are very different upon different occasions. The conditions of the materials which he works upon, too, is as variable as that of the instruments he works with, and both require to be managed with much judgment and discretion. The common ploughman, though generally regarded as the pattern of stupidity and ignorance, is seldom defective in this judgment and discretion: he is less accustomed, indeed, to social intercourse than the mechanic, who lives in town. His voice and language are more uncouth and more difficult to be understood, by those who are not used to them. His understanding, however, being accustomed to consider a greater variety of objects, is generally much superior to that of the other, whose whole attention, from morning till night, is commonly occupied in performing one or two simple operations. How much the lower ranks of people in the country are really superior to those of the town, is well known by every man, whom either

business or curiosity has led to converse much with both. In China and Indostan, accordingly, both the rank and the wages of country labourers are said to be superior to those of the greater part of artificers and manufacturers. They would, probably, be so every where, if corporation laws, and the corporation spirit, did not prevent it."

It is, without doubt, a circumstance that operates unfavourably to the improvement of husbandry, to depreciate the acquirements of this useful class of society, as is too frequently the case, by depressing the necessary ardour and spirit of exertion.

HUT, a humble sort of building, mostly constructed of some earthy material, as mud, clay, &c. It is observed by the author of the "Practical Planter," that many neat-looking huts and other dwellings are built on the River South Esk, in Scotland.

"At a distance they seem, he says, built of brown bricks. It is composed of a muddy clay, intermixed with the roots of plants; and is dug from out the flood-mark of the river, in any size or shape, according to the purpose for which it may be wanted. The sods or peats are generally of the brick form, but larger. They are manufactured in all respects as peat-fuel. Some build them with lime, but they are more generally built with clay. The inhabitants prefer these huts to those of stone: 'they are warmer,' and are said to last for many generations." This sort of mud might, he supposes, be found in many places, were it searched after, and be employed for this purpose, as well as that of fences of the wall kind, as they would be durable.

HYDATIDS, in *farriery*, transparent bags filled with watery liquid, and of which there are two species. That of the first sort is *organised*, and connected with the vessels by peduncles. It consists of a bag or bags of different sizes, filled with serum: as these bags increase, they thicken. Sometimes their contents are bloody, and flakes of coagulable lymph are floating in them. This kind of hydatids only disturb by their size.

But the second are supposed to be confined to the liver, and to consist of a strong bag formed in the substance of that viscus. This bag is vascular, and lined with a soft, pulpy, opaque coat, resembling the retina of the eye. It contains a liquor of a whey colour, in which a number of detached vesicles are found swimming, or there is a series of them, one within another. This sort is productive of worse effects than the former. The bag sometimes bursts, and its contents falling into the cavity of the belly, a kind of ascites is the consequence: its external cyst is subject to inflammation, and adhesion to the adjacent parts, whence, if suppuration take place, various ill consequences may follow.

It is remarked, that hydatids of the first kind are found within the skull in sheep affected with the vertigo, or, as it is vulgarly called, the *gid*; and their removal by trepanning, though itself a hazardous operation, is perhaps the only method of cure likely to be successful in such cases.

HYDROCARBONATE-*Gas*, the name of an elastic fluid formed during the decomposition of water. It is observed by the author of Phytologia, that "during the putrefactive process, carbon is not only converted into carbonic acid, but there appears to be a decomposition of water, as is known by the smell of hydrogen; and it is probable that this inflammable body may unite with carbon, as in hydrocarbonate gas, and thus render them both soluble in water, and absorbable by the vessels of vegetable roots, without their passing into an acid or gaseous form, and may much contribute to the nutriment of vegetables."

HYDROGENE, a term applied by modern chemistry to one of the constituent principles of water, or what was formerly known under the title of Inflammable Air.

HYDROPHOBIA, in *farriery*, a sort of disease or symptom of that species of madness caused by the bite of a mad animal, whence the distemper is called so itself; but this symptom is not peculiar to this disease, nor always attendant on it. The disorder is called *rabies canina.* This kind of madness properly belongs to the canine genus, as dogs, foxes, and wolves, to whom only it seems natural, scarcely ever appearing in other animals, except it be inflicted by those of the dog-kind. And by Dr. Heysham it is defined to be an aversion and horror at liquids, as exciting a painful convulsion of the pharynx, occurring at an indetermined period, after the virus has been received.

It is said that, in all animals, the hydrophobia is a nervous disorder, though followed by inflammatory symptoms: and there is a loathing and great dread of drinking any liquids, because of creating a painful convulsion of the pharynx. See *Canine Madness*.

HYGRA, in *farriery*, a term signifying a liquid plaster; also liquid rosin.

HYGROMETER, an instrument which may be employed for ascertaining the state of the atmosphere in respect to moisture or dryness, and in these ways be useful to the farmer. Mr. Marshall says, that a simple instrument of this sort may be formed by means of "a flaxen line (large well manufactured whipcord) five feet long; and having a graduated scale fixed to an iron hand, or index, moving on a fulcrum. The length of the index, from the fulcrum to the point, should be ten inches; that of the lever, from the fulcrum to the middle of the eye, to which the cord is fixed, two and a half inches." He adds, that "the principle, on which this hygrometer acts, is obvious. The air becoming moist, the cord imbibes its moisture; the line, in consequence, is shortened, and the index rises. On the contrary, the air becoming dry, the cord discharges its moisture,—lengthens,—and the index falls. It may be true, he says, that no two hygrometers will keep pace with each other sufficiently to satisfy the *curious*. He will venture to say, however, from seven months' close attention, that two hygrometers, on this simple construction, have coincided sufficiently for the uses of agriculture. It is true, he adds, they diminished in the degree of action; but as the scale may be readily diminished in extent, and as a

fresh line may be so cheaply, and so readily, supplied, this is not a valid objection."

It is remarked, that "this diminution, in the degree of action depends considerably on the construction; the propriety, or rather delicacy, of which rests, almost solely, on this point:—The weight of the index should be so proportioned to the weight of the lever and cord, that the cord may be kept perfectly straight, without being too much stretched. He made one with a long heavy index; and, in order to gain a more extensive scale, with a short lever: but, even when it was first put up, it could barely act; and, in a few weeks, it flagged, and was not able to raise the index, though the air was uncommonly moist. He therefore made another, with the same length, both of index and lever, but with a lighter index, and a heavier lever, so as to gain the proportion above mentioned; and it has acted exceedingly well."

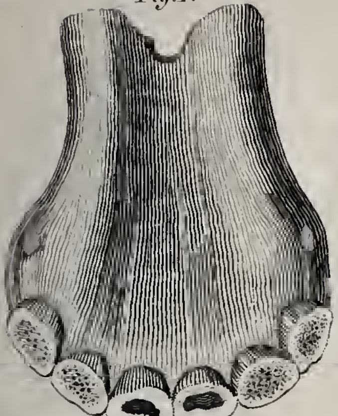
He thinks that no farmer, "who wishes to profit by the hygrometer, should have less than two. Three or four would be more advisable. They would then assist, in correcting each other; and, in case of renewal or alteration, there would be no danger of losing the state of the atmosphere; which, if only one is kept, must necessarily be the case. The principle, on which this hygrometer is formed, is not, he says, confined to a small cord, and an index of ten inches long: it may be extended to a rope, of any length or thickness, and to an index and scale, of almost any dimensions and extent." But "one, or more, on a portable construction, might, he thinks, be found useful. An axe is the form he has thought of. The edge, graduated, will constitute the scale; and the handle will receive the cord. This may be hung up, in the shade, exposed to the action of the air; or, by means of a spike in the end of the handle, it may be placed in the open field. Perhaps, by placing it on fallow ground, it may be actuated by the perspiration of the earth; perhaps, among vegetables, by vegetable perspiration; perhaps by the means of one, or more probably by the means of several, placed at varied heights, the different degrees of moisture, at different altitudes, may be ascertained, &c. In fact, he considers the hygrometer, whether it is a prognostic of the weather or not, as a most valuable oracle to the farmer." See *Weather*.

END OF THE FIRST VOLUME.

PRINTED BY RIDER AND WEED, LITTLE BRITAIN.

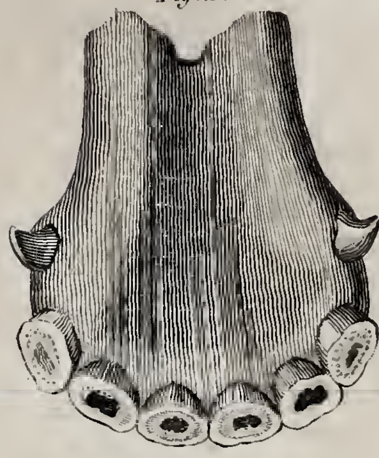
AGE of HORSES.
Shewn by their Teeth.

Fig. 1.



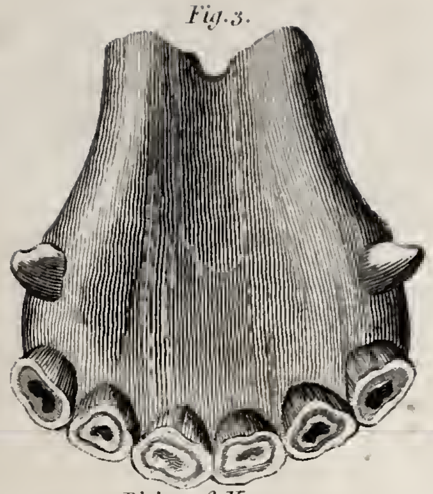
Rising 3 Years.

Fig. 2.



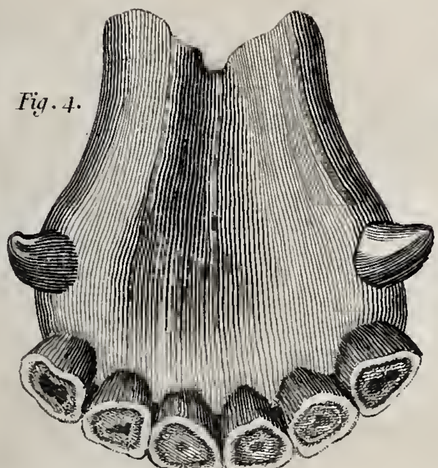
4 Years old.

Fig. 3.



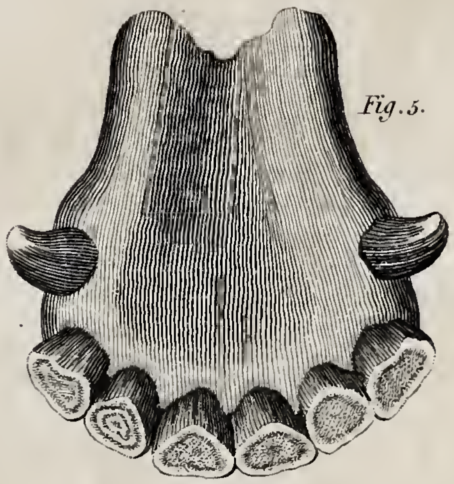
Rising 6 Years.

Fig. 4.



7 Years old.

Fig. 5.



12 Years old.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Publish'd as the Act directs April 1 1806 by Longman, Rees, Hurst & Orme, Paternoster Row.

Drawn & Engrav'd by C. Hunt.

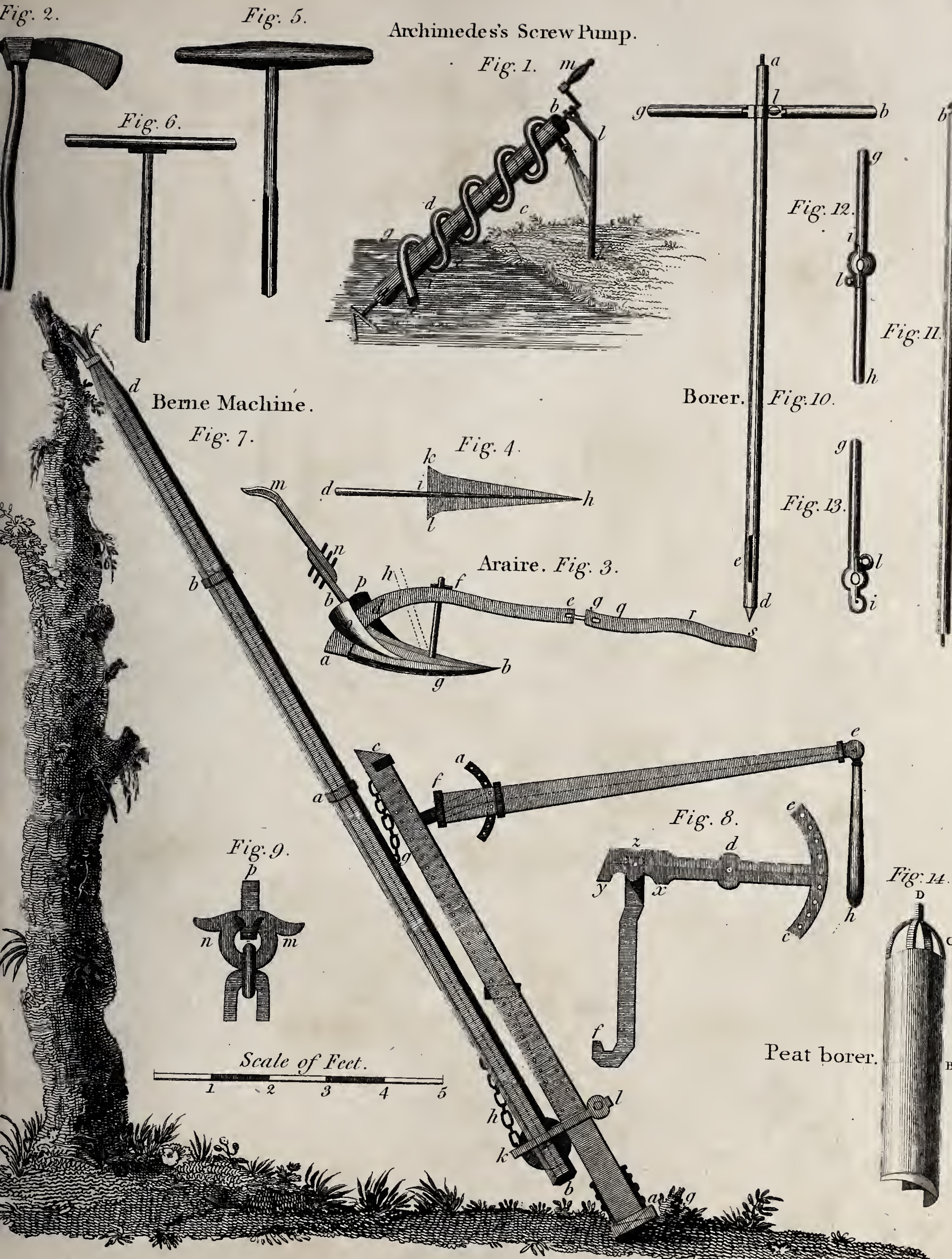
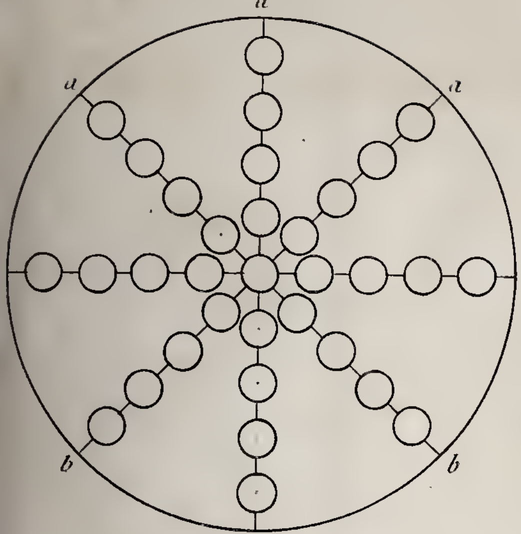


Fig. 2.
Fig. 5.
Archimedes's Screw Pump.
Fig. 1.
Fig. 6.
Fig. 12.
Fig. 11.
Berne Machine.
Fig. 7.
Borer.
Fig. 10.
Fig. 4.
Fig. 13.
Araire. Fig. 3.
Fig. 8.
Fig. 9.
Fig. 14.
Scale of Feet.
1
2
3
4
5
Peat borer.

ATTRACTION.

Fig. 1.



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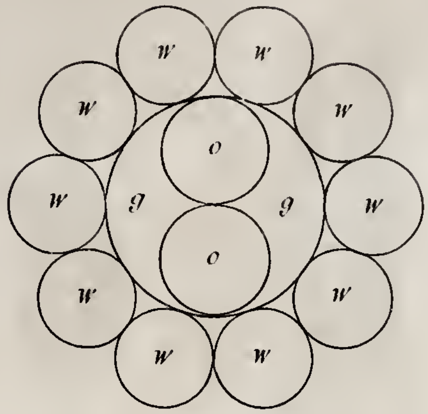

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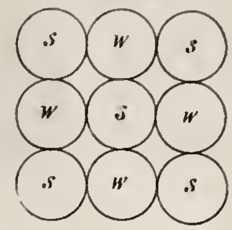

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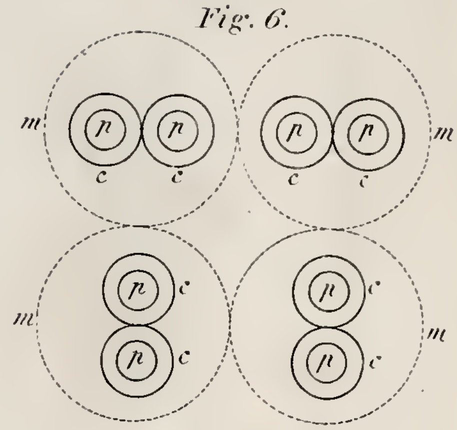

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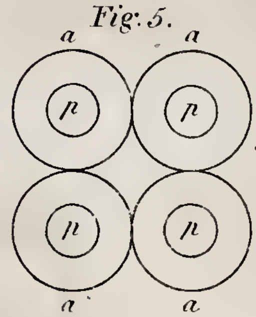


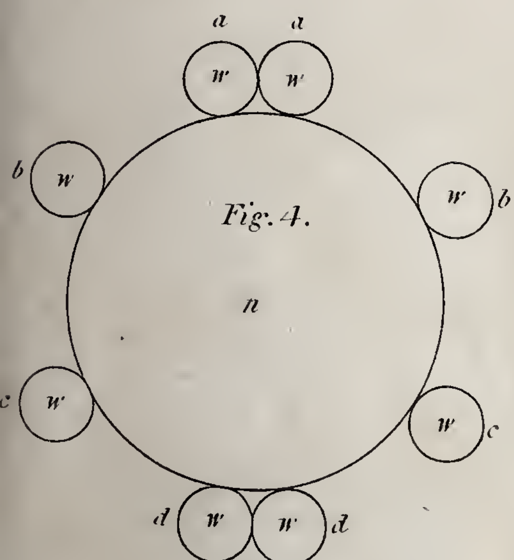
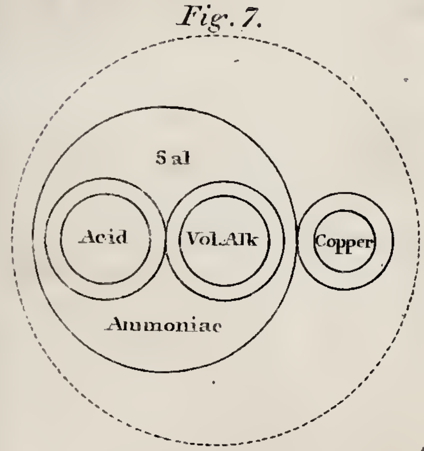


Fig. 4.

Fig. 7.



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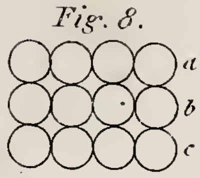


Barley

Fig. 9.

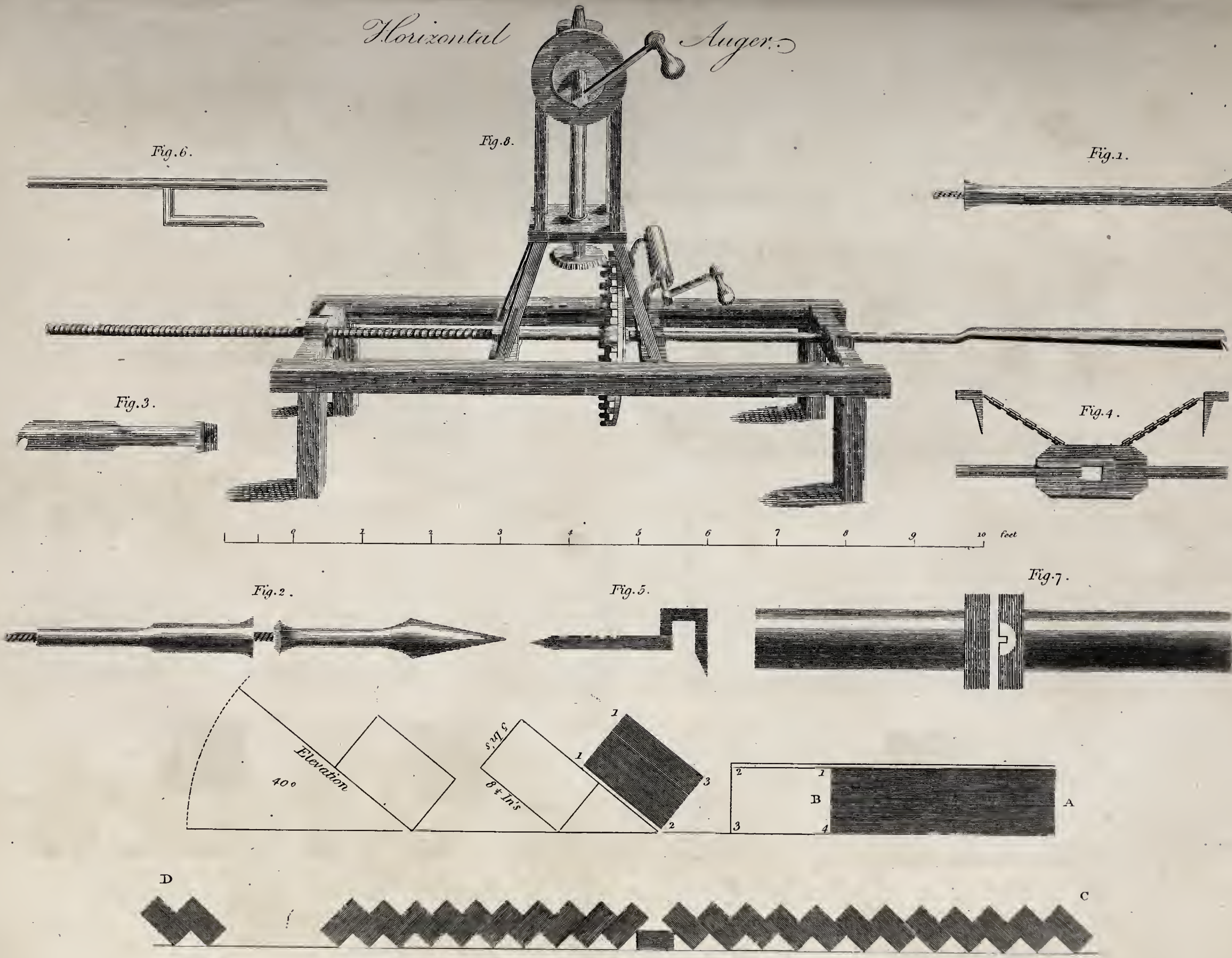
Burnet

Fig. 11.

Bastard Alkanet

Fig. 10.

Horizontal Auger.



Publish'd August 1.1806, by Longman, Hurst, Rees, & Orme, Paternoster Row.

Blunt delin et sculp

BARNS.

Plate V. Vol. I.

Common Barn.

Fig. 1.

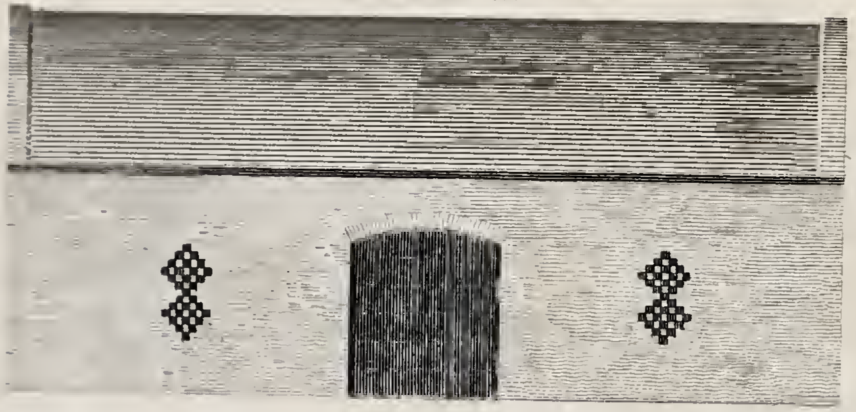
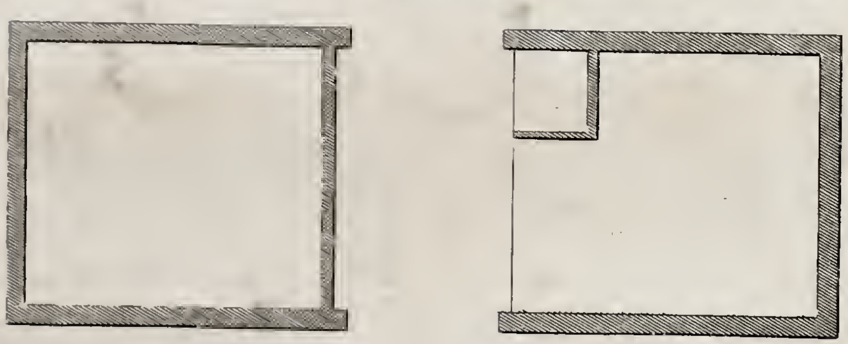


Fig. 2.



Double Barn.

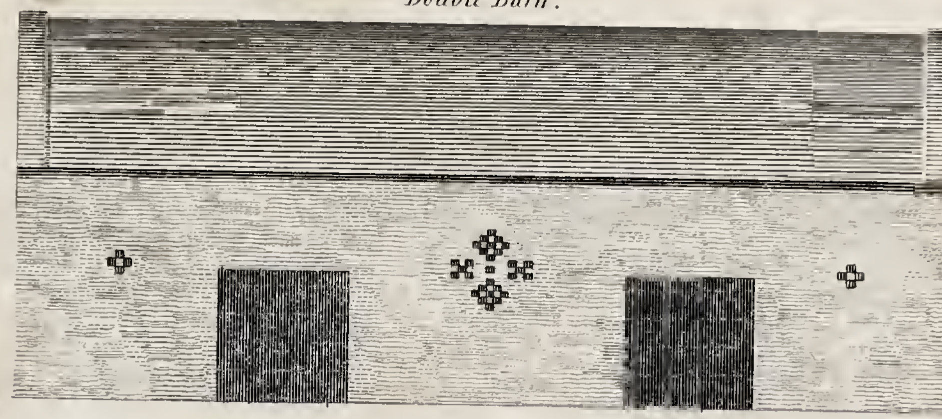


Fig. 3.

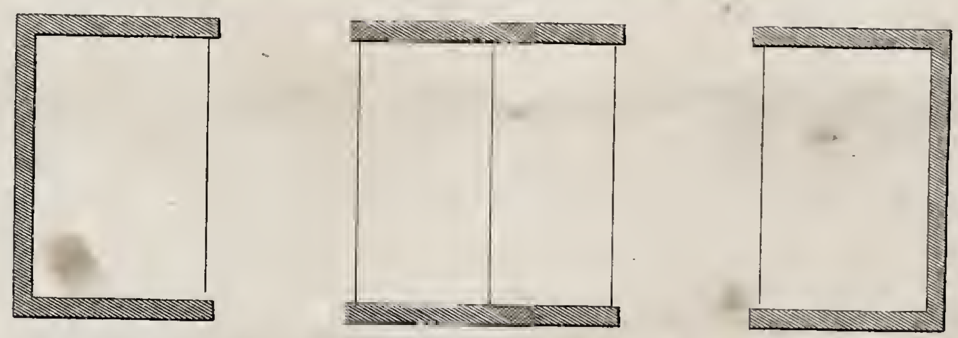


Fig. 4.

Improv'd Barn.

Fig. 5.

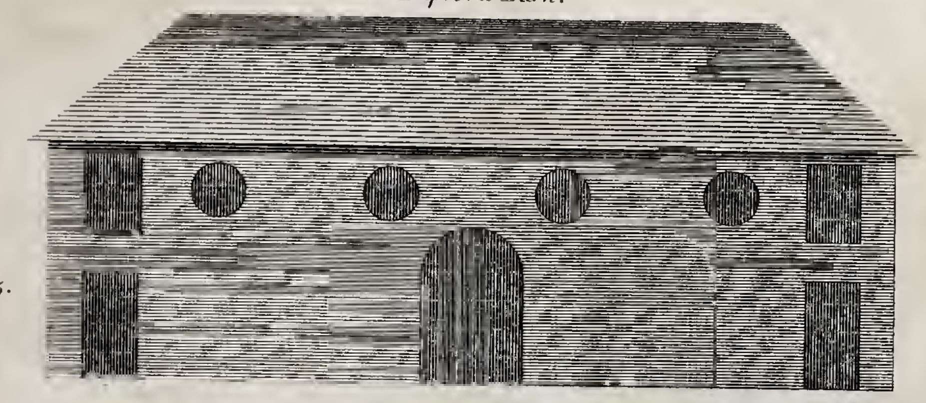
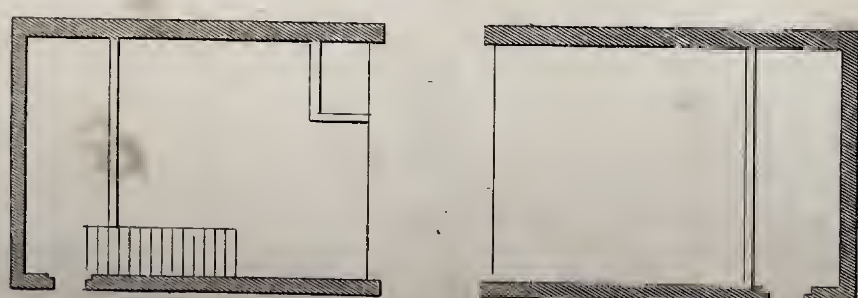


Fig. 6.



Dutch movable Barn.

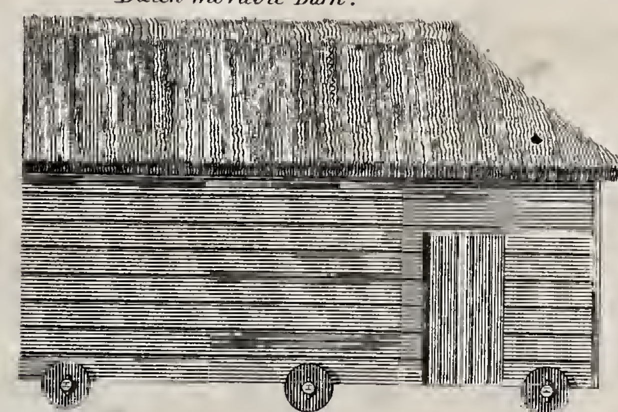


Fig. 7.

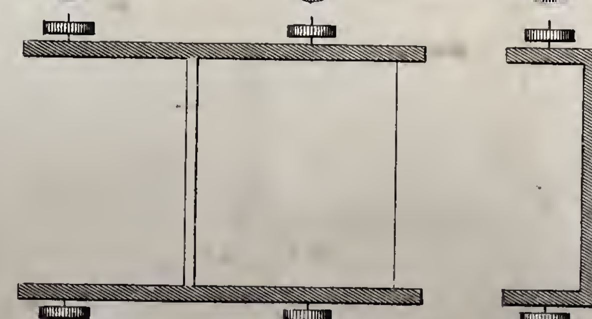


Fig. 8.

...n with Granary & Water Thrashing, Corn & Barley Mill.

Barn with Granary, and Thrashing Mill.

Fig. 1.

Fig. 5.

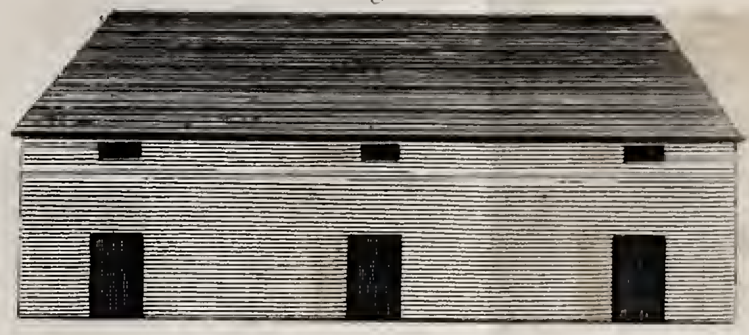


Fig. 3.

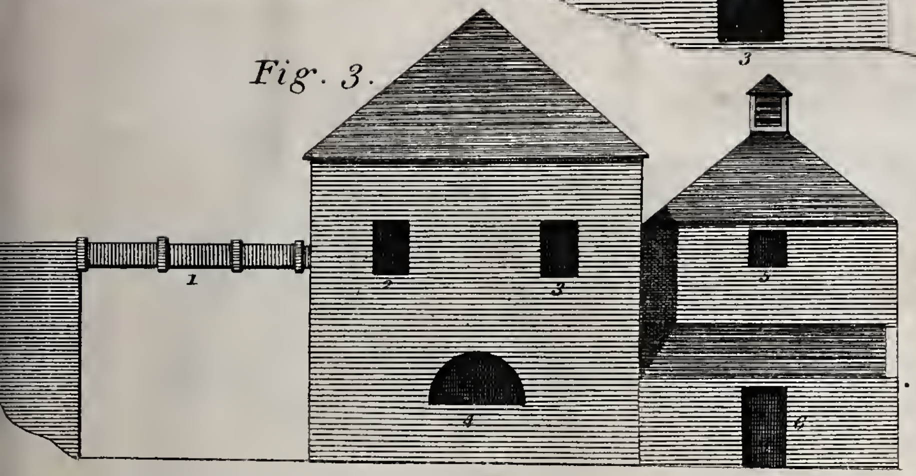
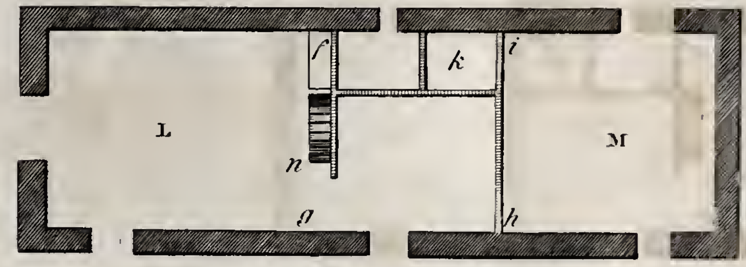


Fig. 8.



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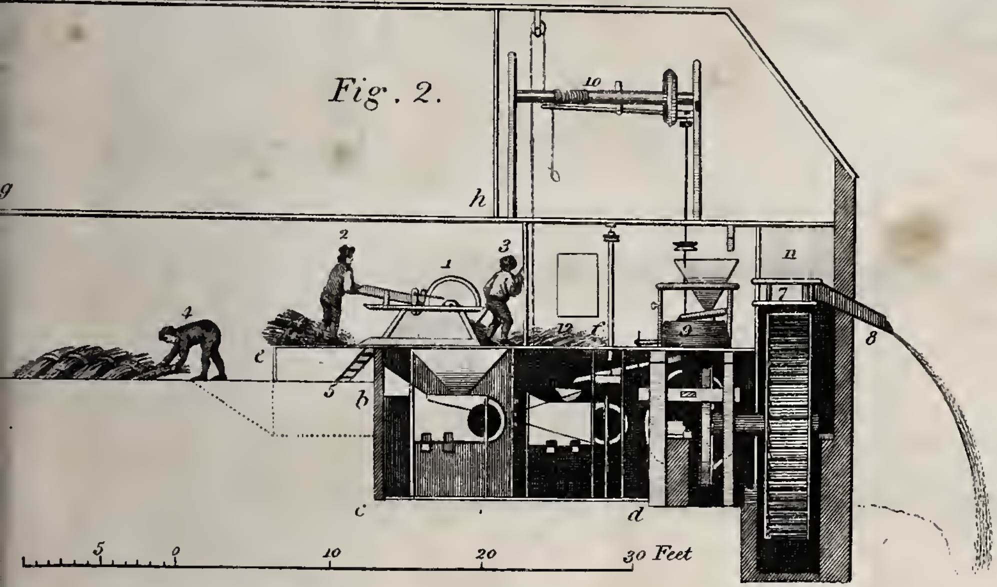
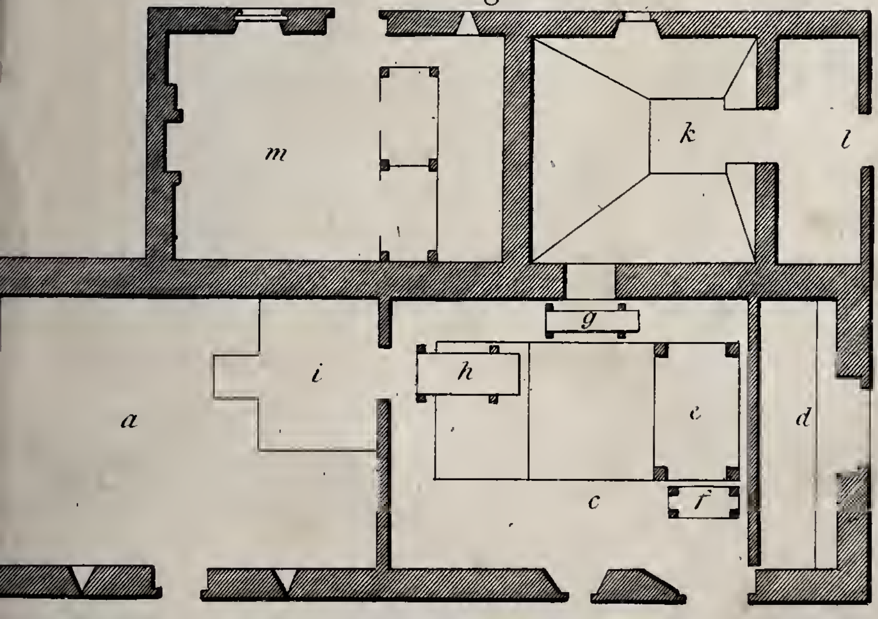


Fig. 6.

Fig. 4.



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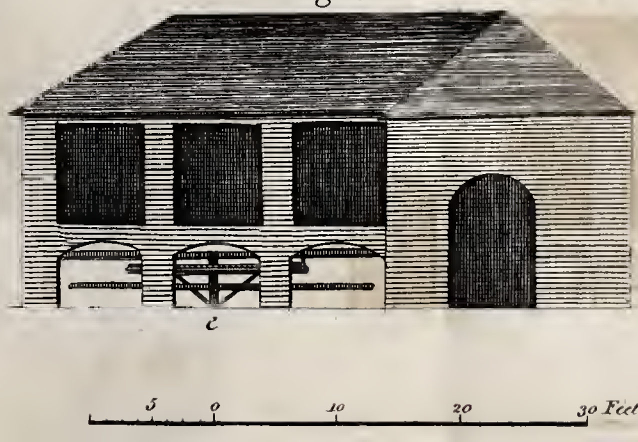
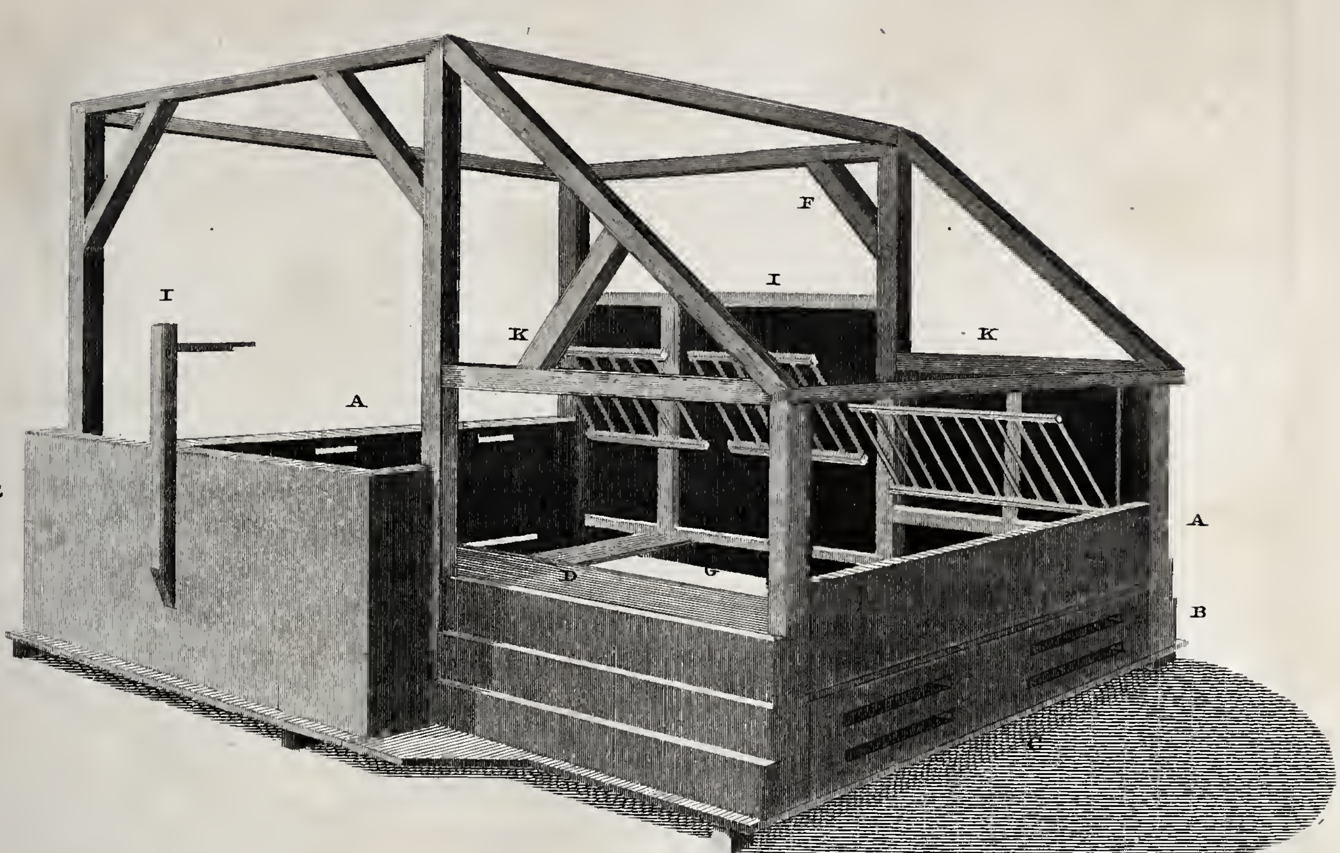
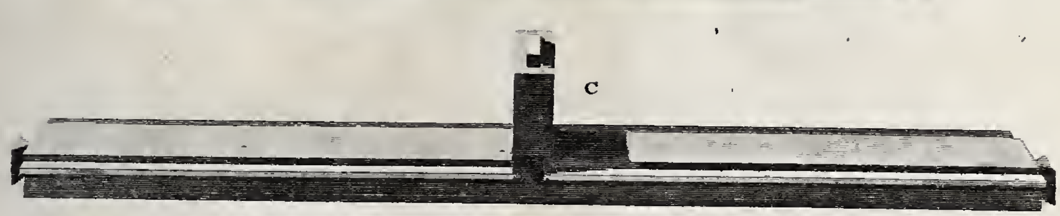
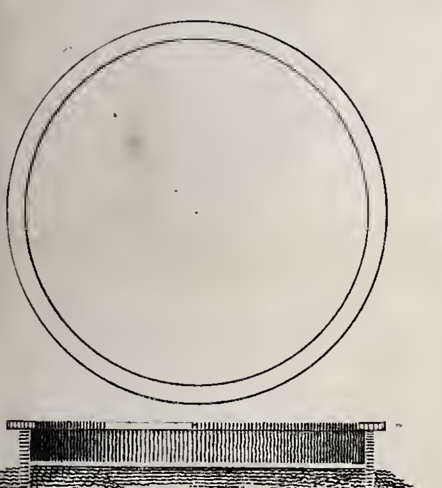


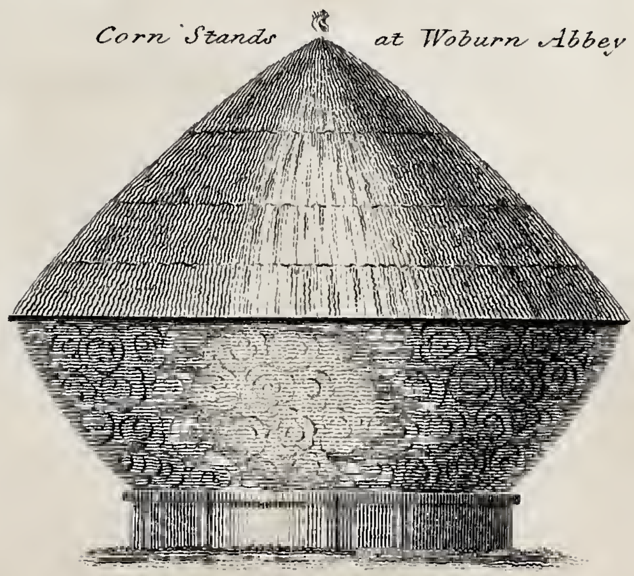
BARN FLOORS



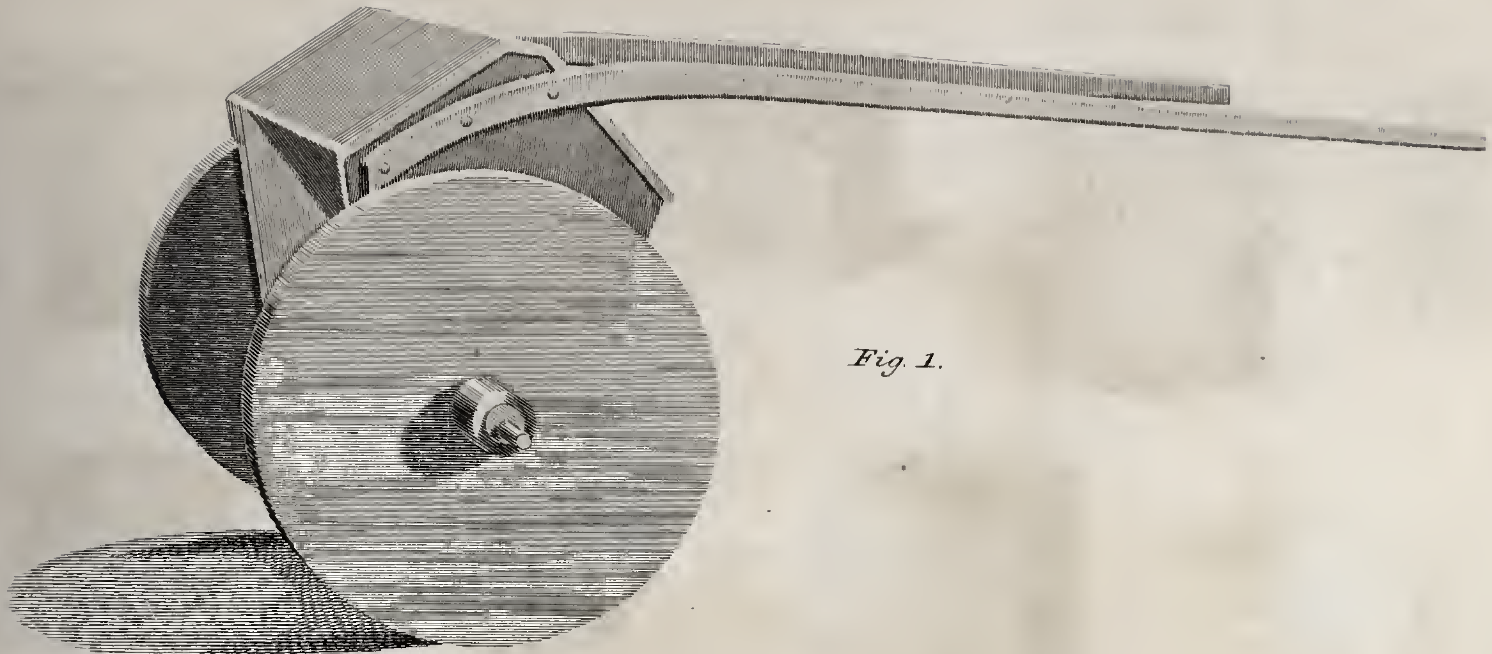


Corn Stands at Woburn Abbey





BEAN DRILL



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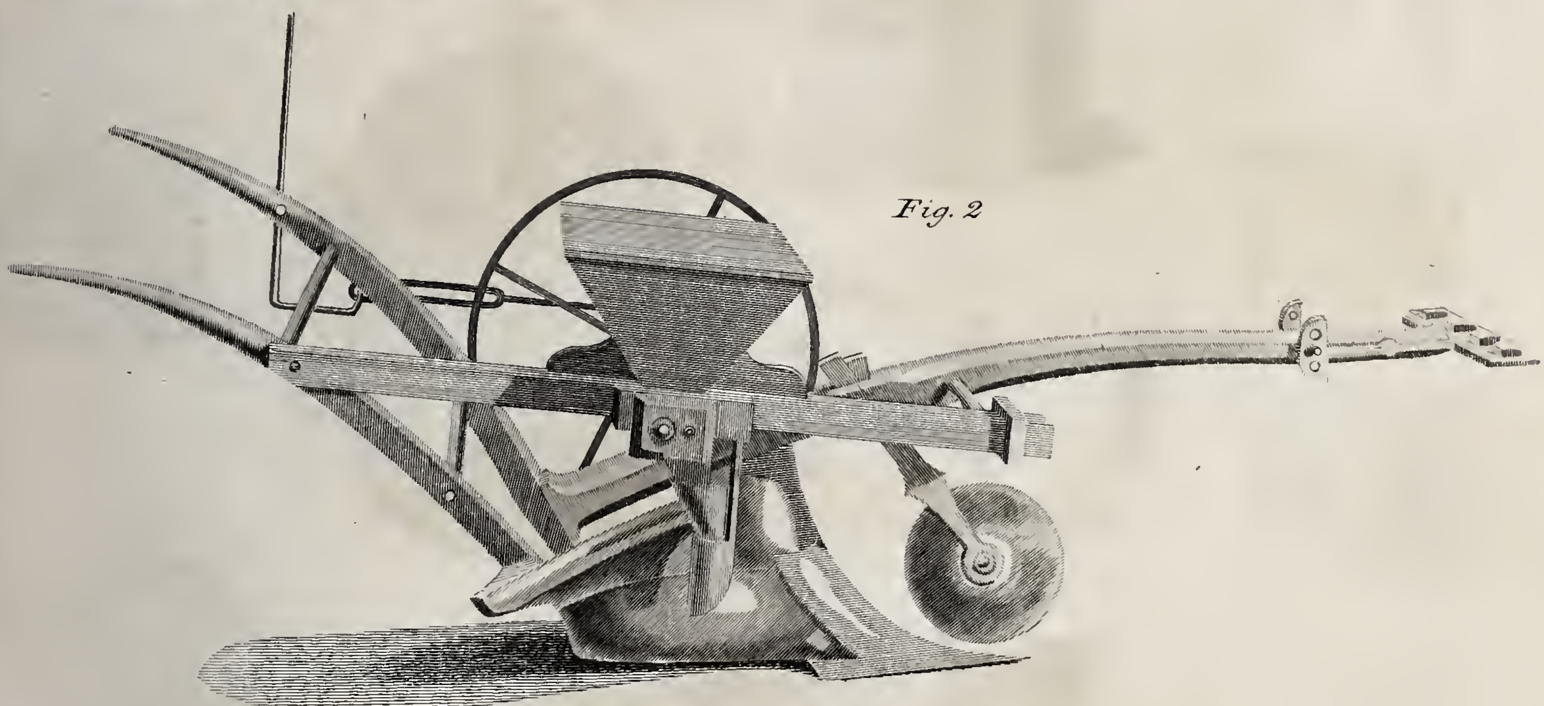


Fig. 2

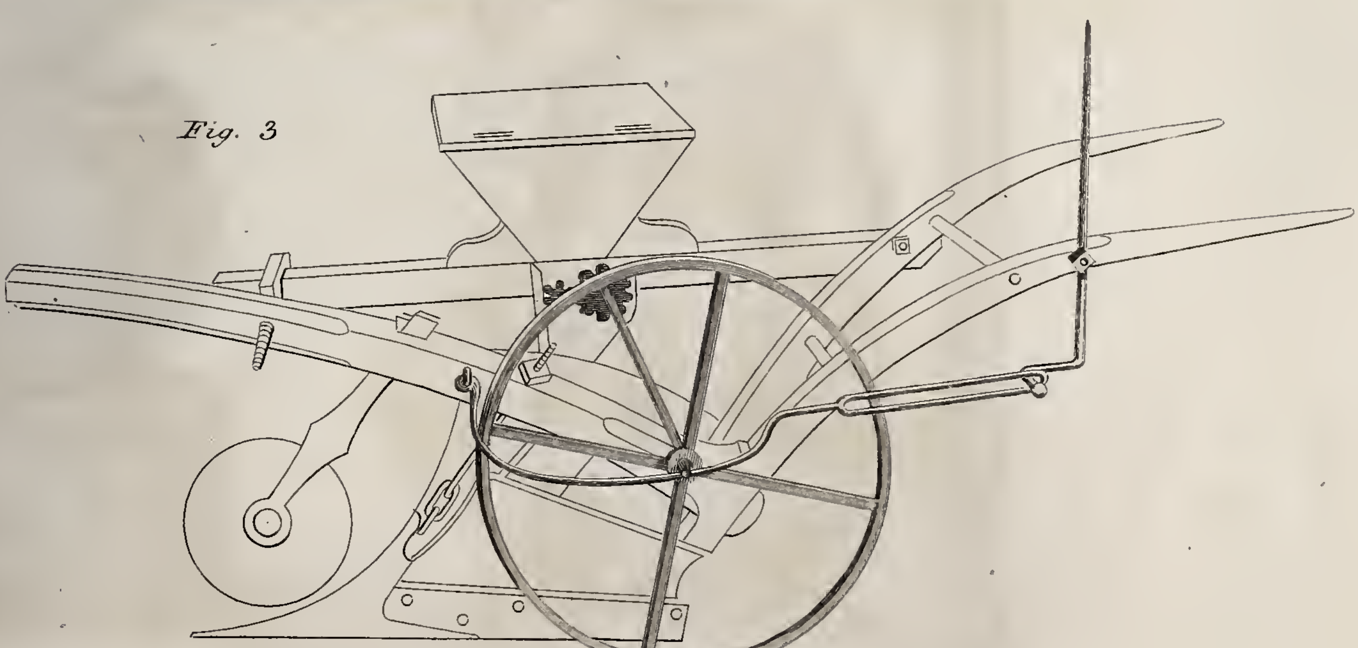


Fig. 3

BEE APPARATUS.

Fig. 1.

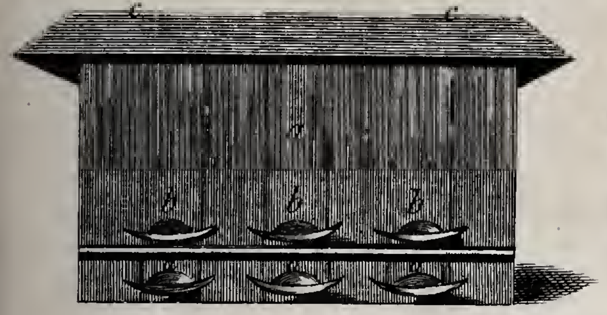


Fig. 2.

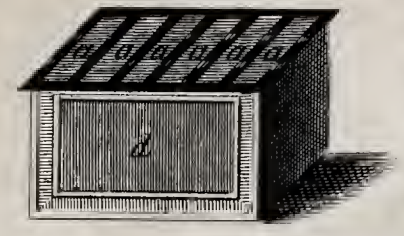


Fig. 3.

Fig. 4.

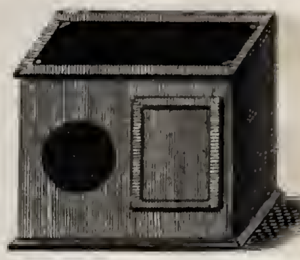


Fig. 5.

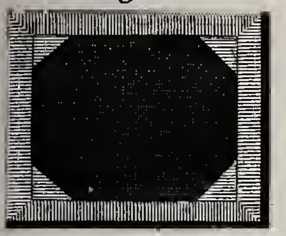


Fig. 6.

Fig. 7.

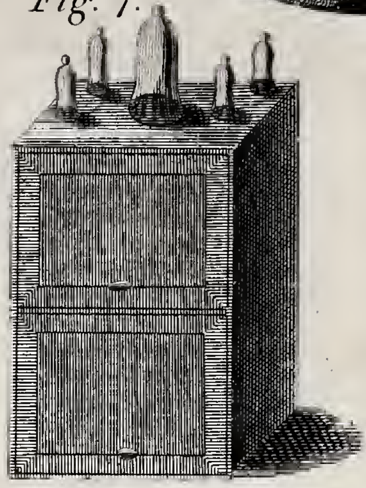
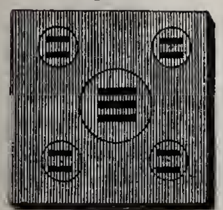


Fig. 8.

Fig. 9.



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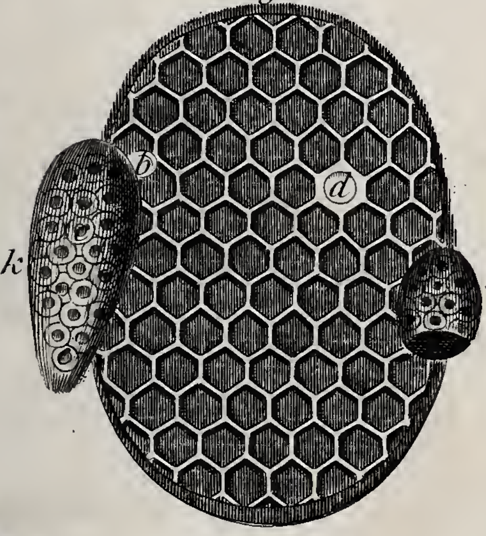
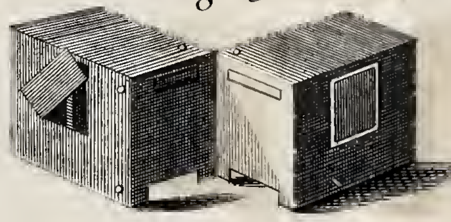


Fig. 11.

Fig. 12.

Fig. 13.

Fig. 15.



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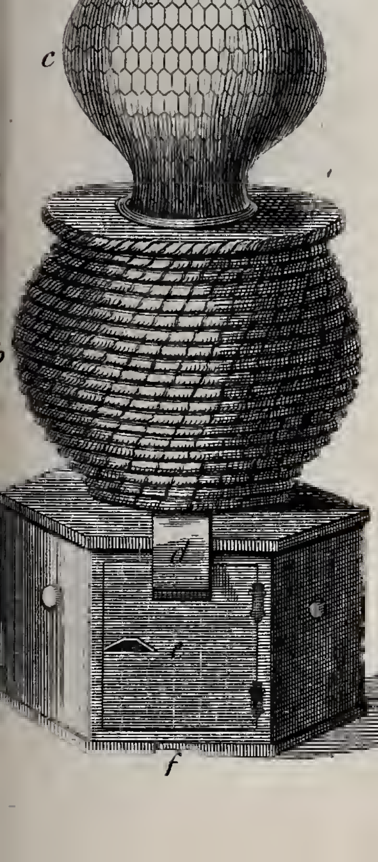

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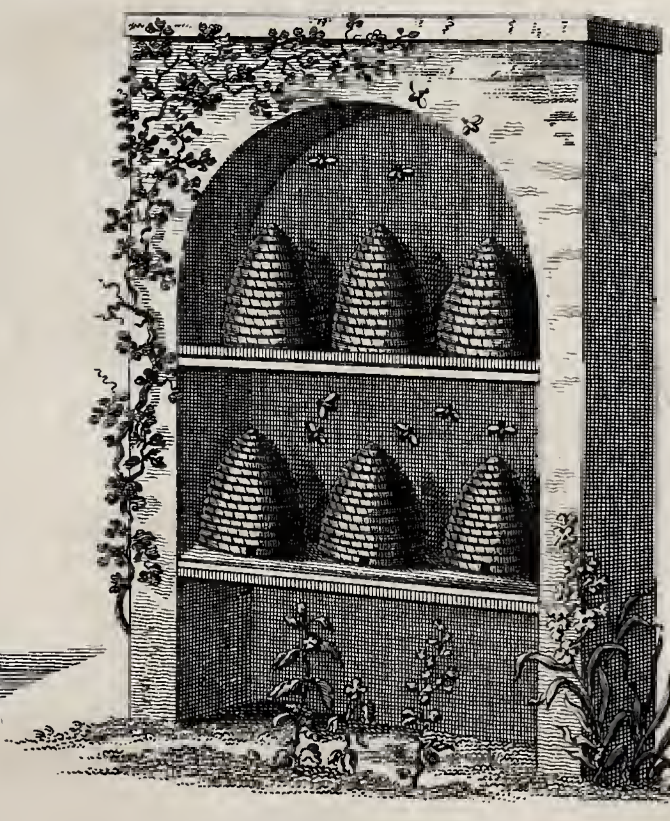


Fig. 16.

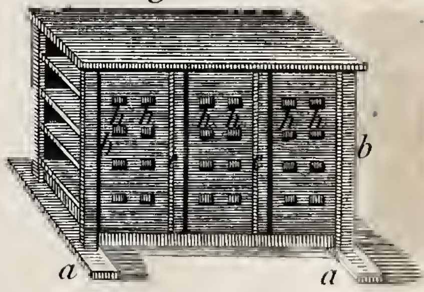
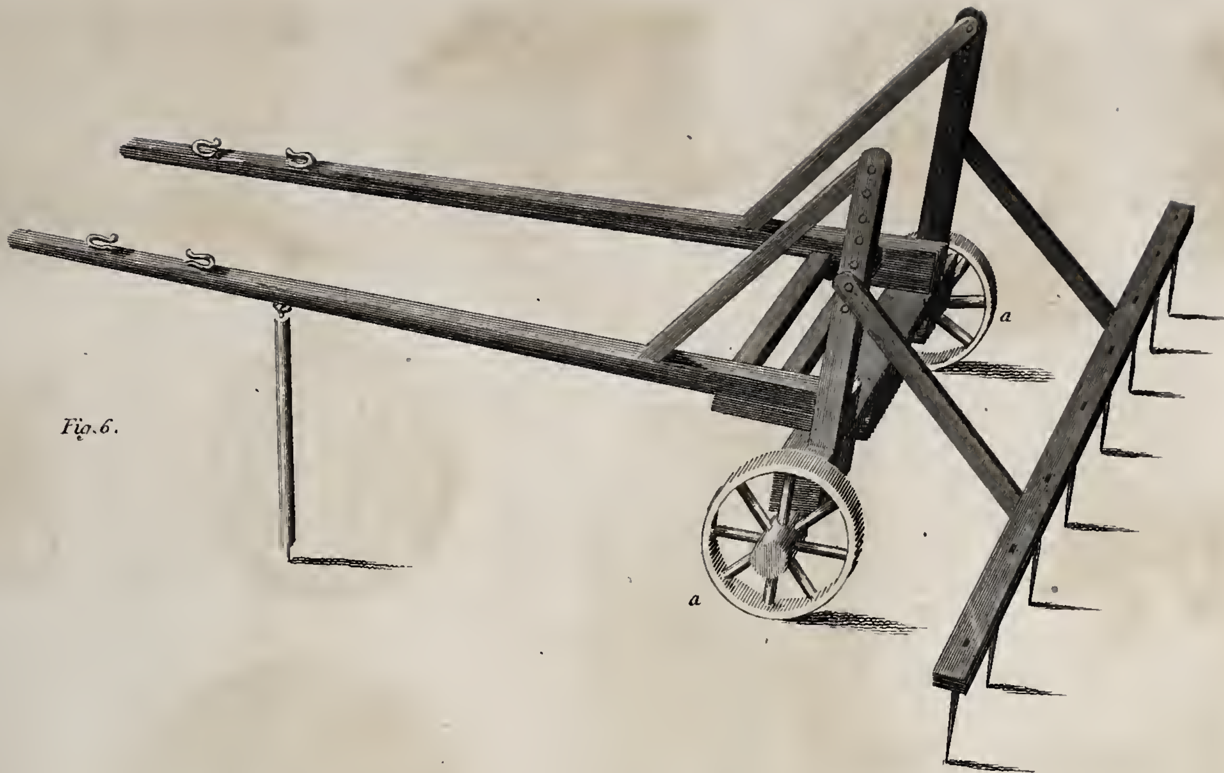
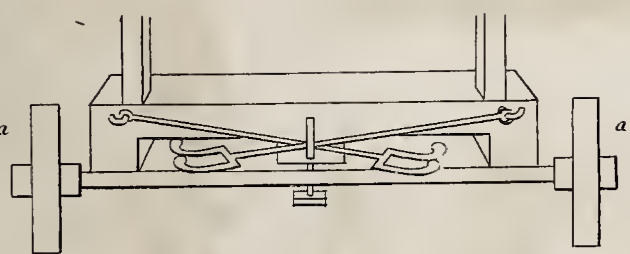


Fig. 17.

BLASTING APPARATUS.

Fig. 6.





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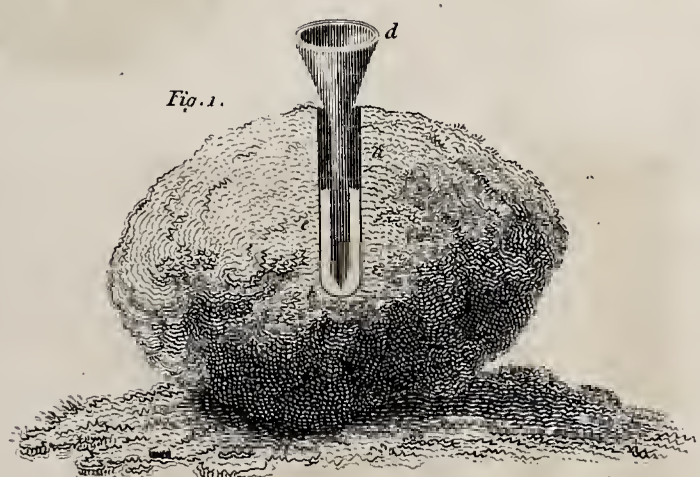

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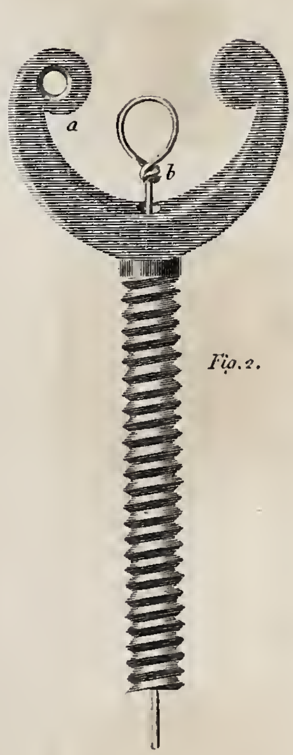

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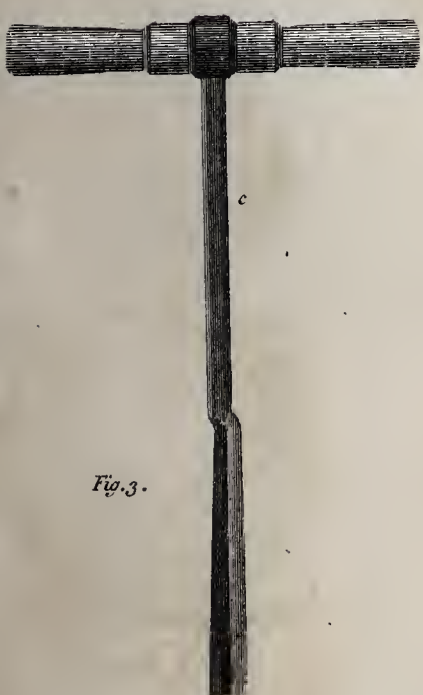
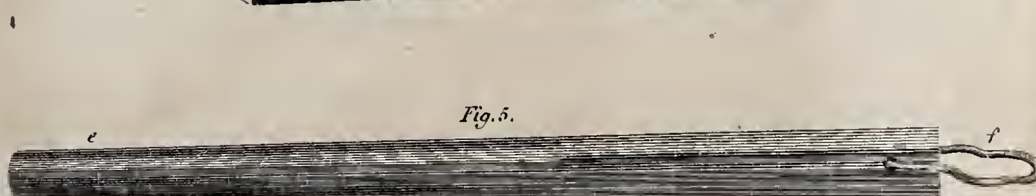


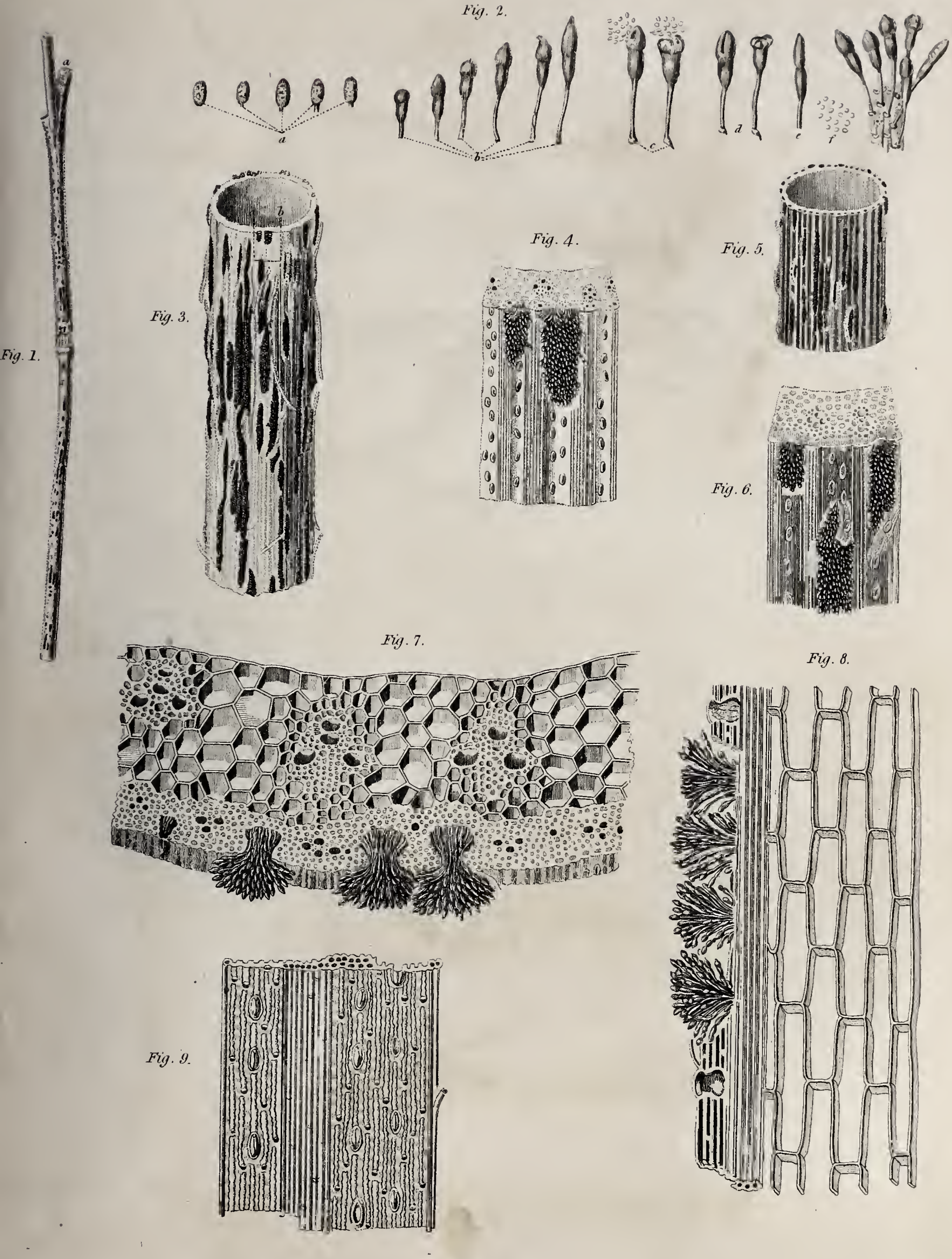
Fig. 4.

Fig. 5.



BLIGHT & MILDEW.

Plate XI. Vol. I



BRUISING MACHINE

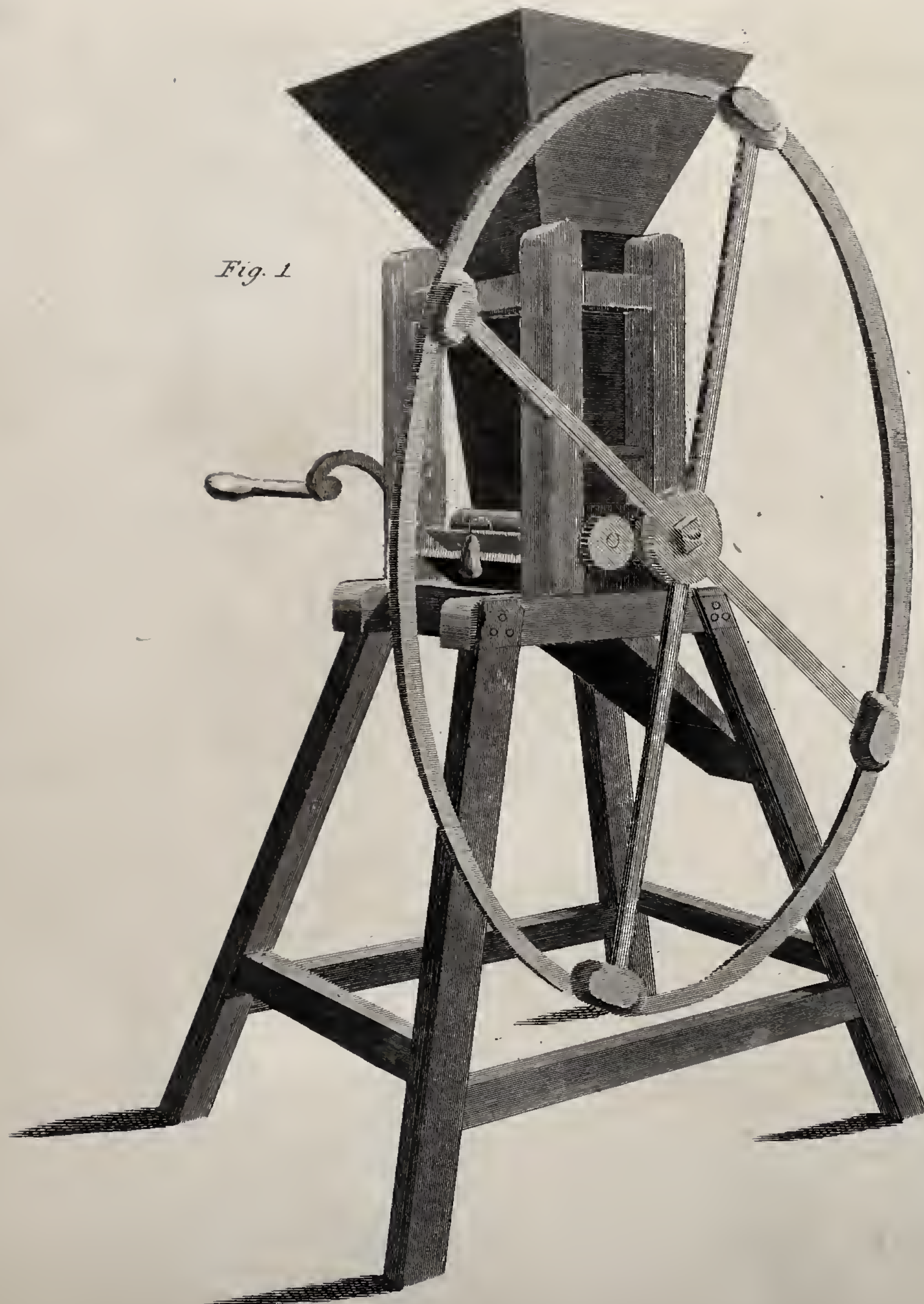


Fig. 1

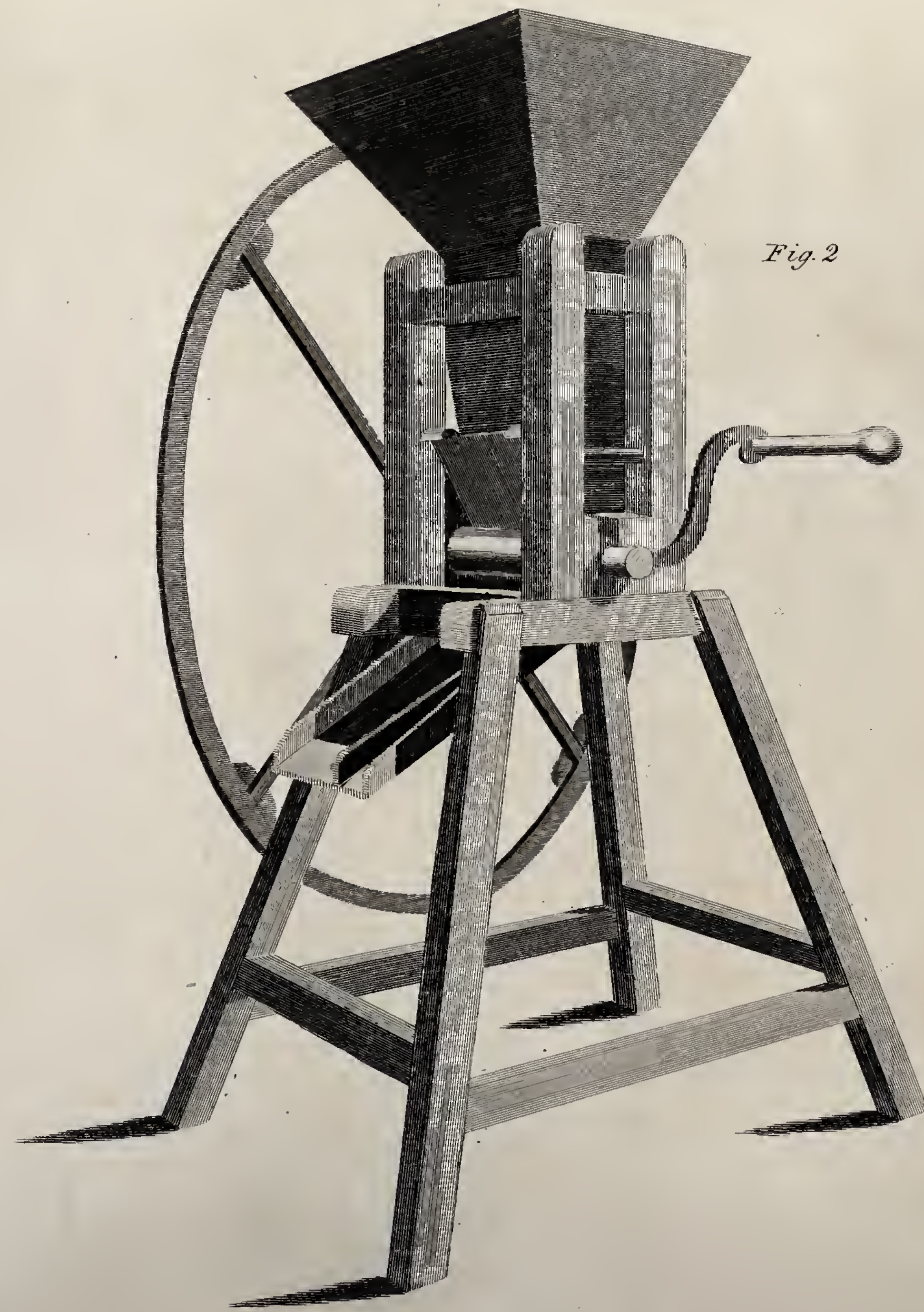


Fig. 2

CARTS.

Fig. 1.

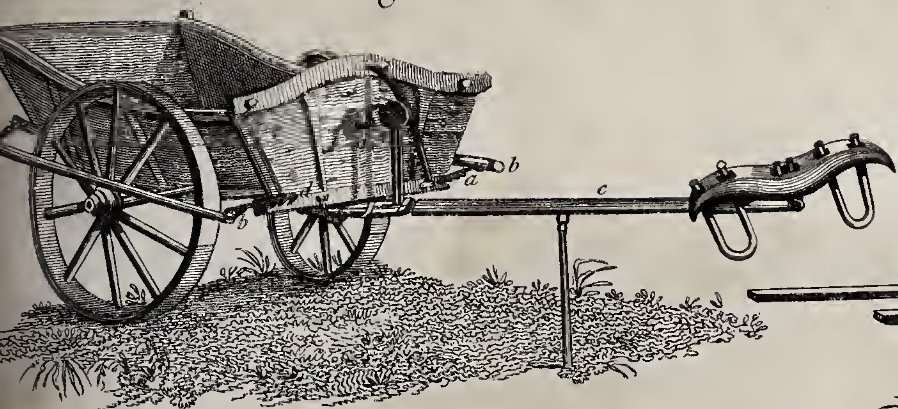
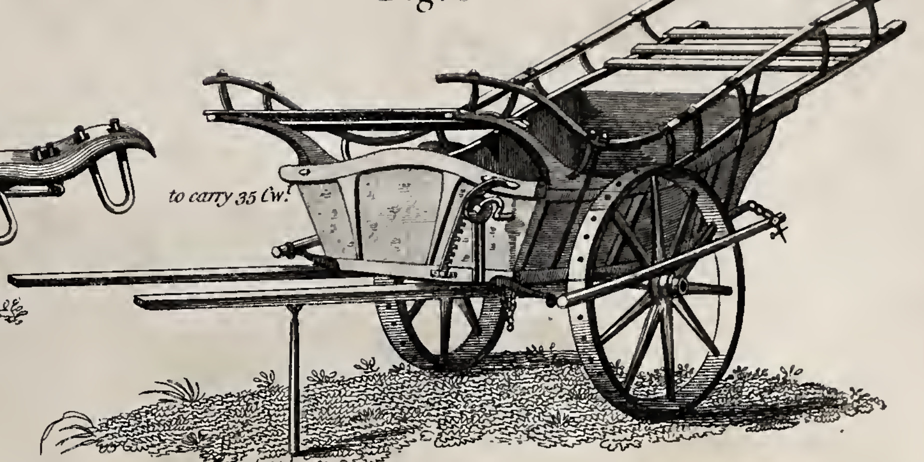


Fig. 3.



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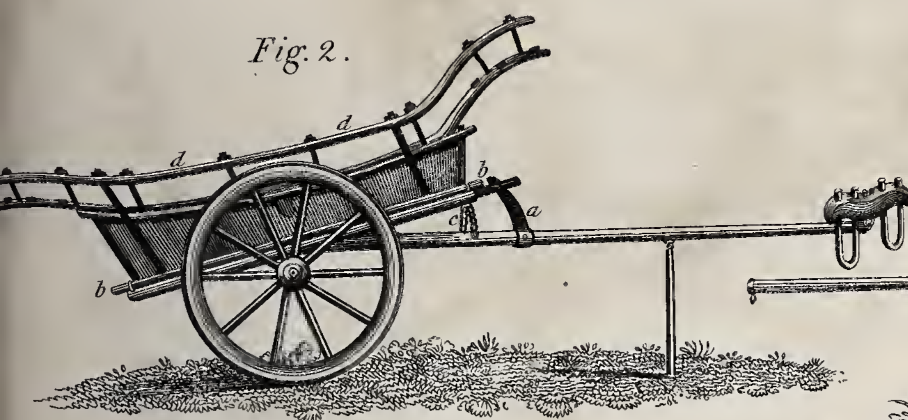

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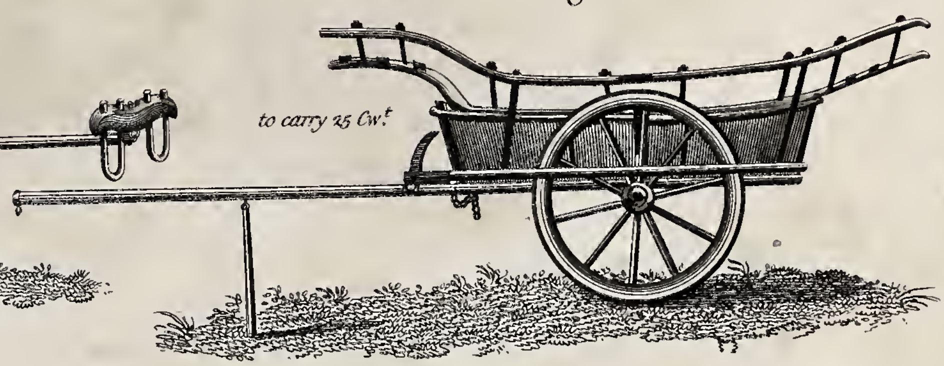

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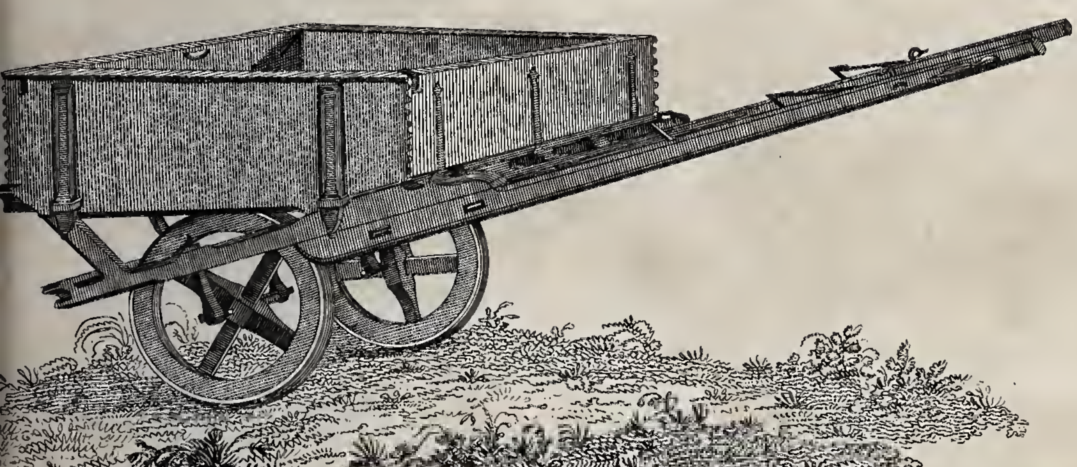

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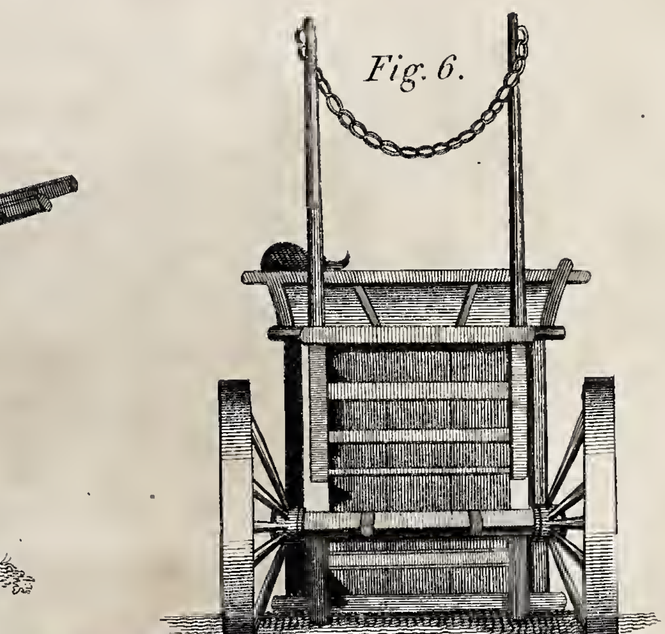

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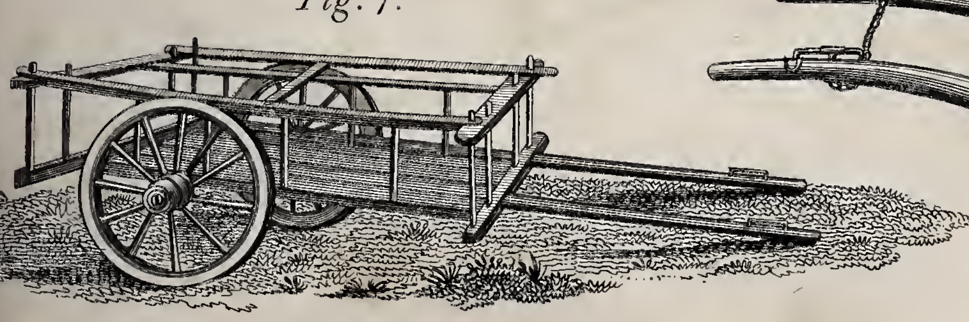

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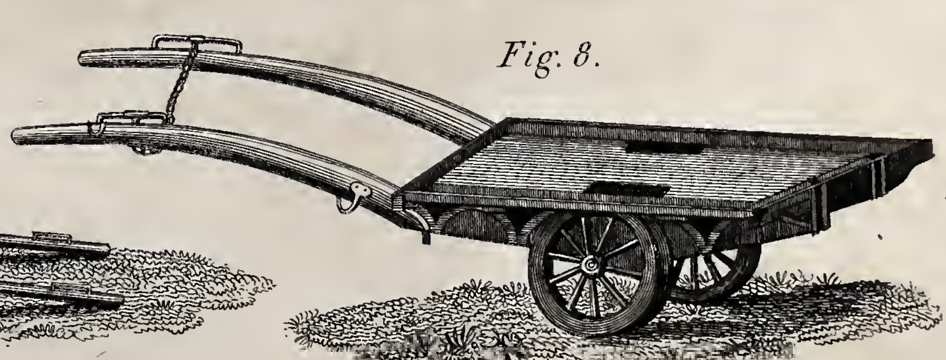
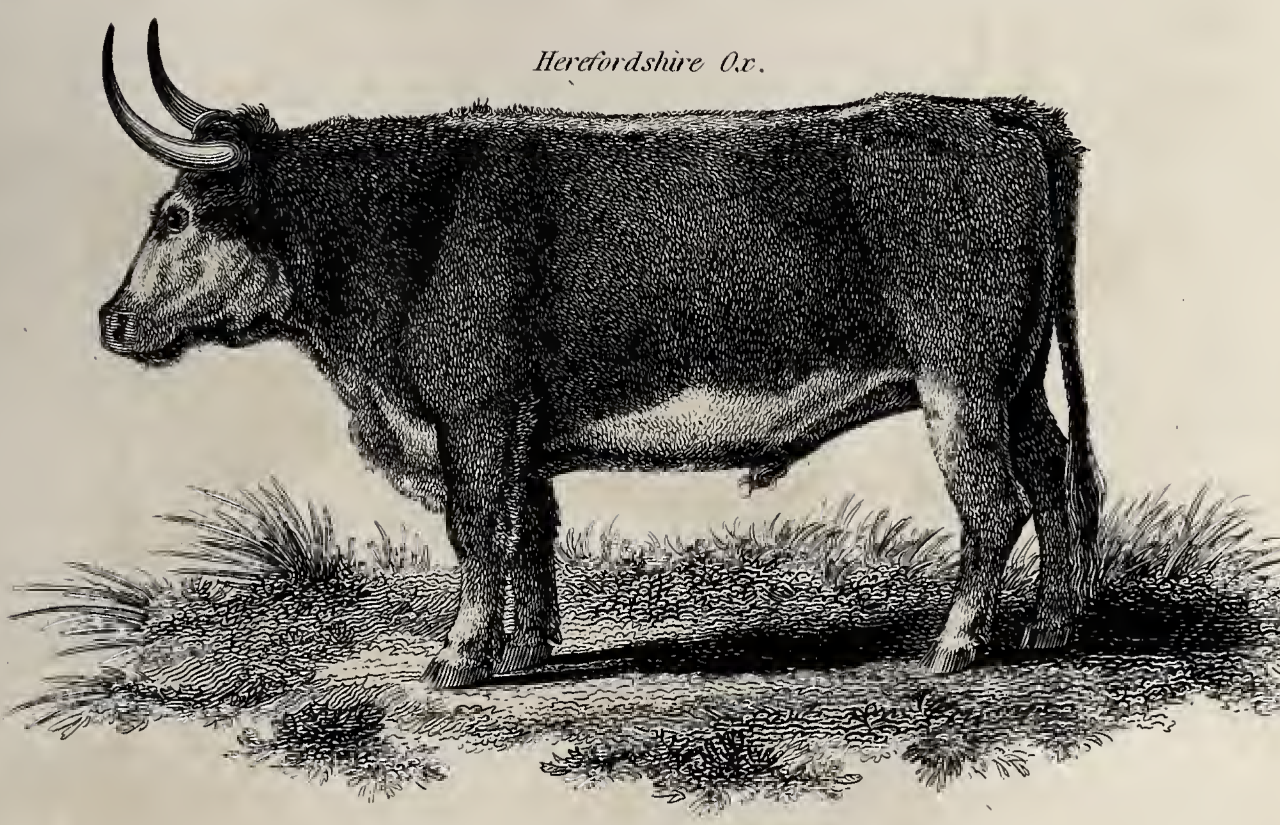


CATTLE.

Sussex Bull.

Herefordshire Ox.



Scott sc

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CATTLE.

Kiloe Ox.

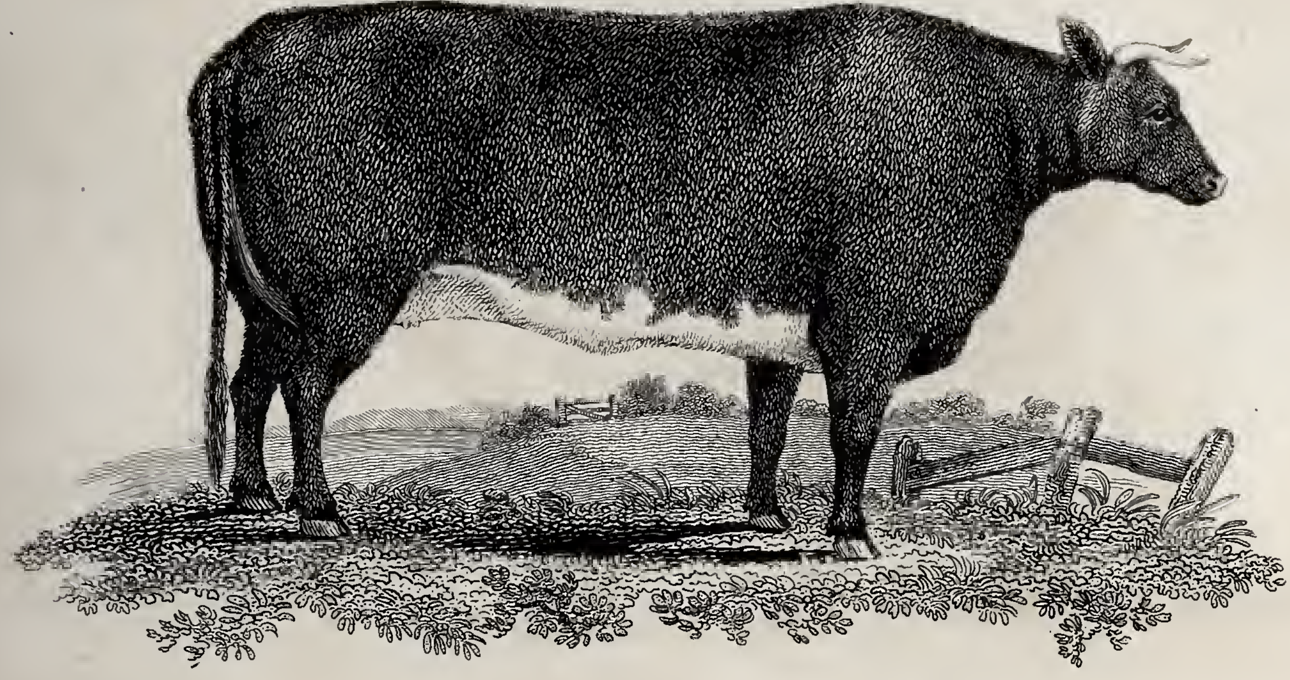
Devonshire Ox.

Scott sc.

Published as the Act directs, June 1.1807, by Longman, Hurst, Rees, & Orme, Paternoster Row.

CATTLE.

Tees-water Heifer.



Sussex Heifer.

Scott sc.

Published as the Act directs, June 1.1807, by Longman, Hurst, Rees, & Orme, Paternoster Row.

ASS CART &c.

Fig. 1.

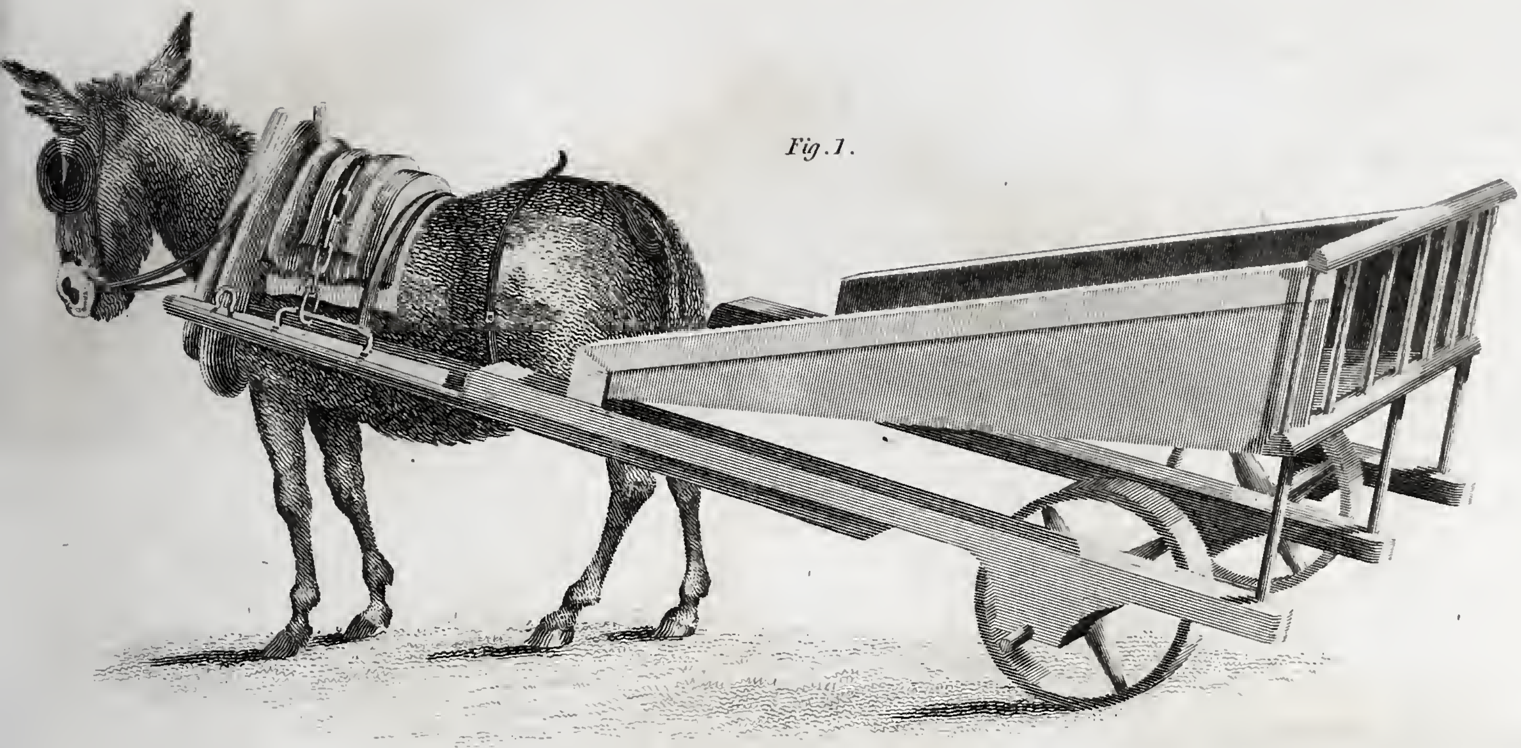


Fig. 5.

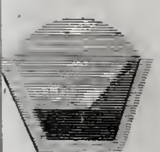
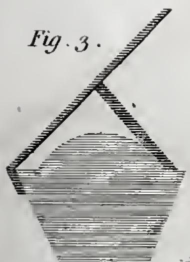


Fig. 3.



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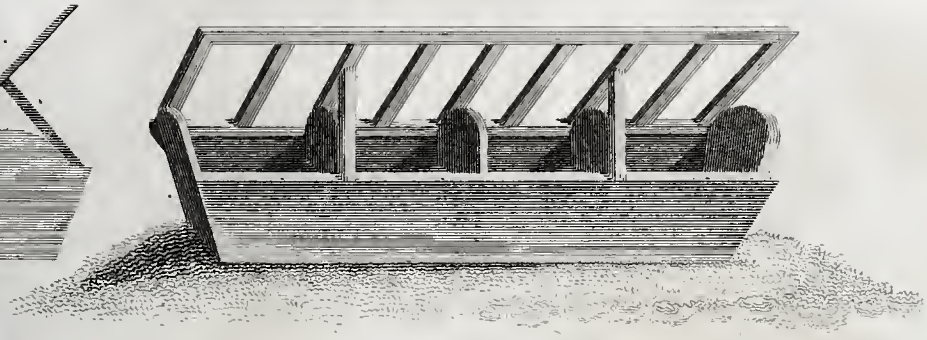

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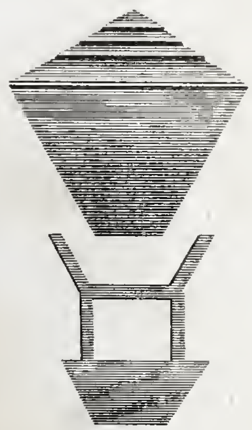


Fig. 7.

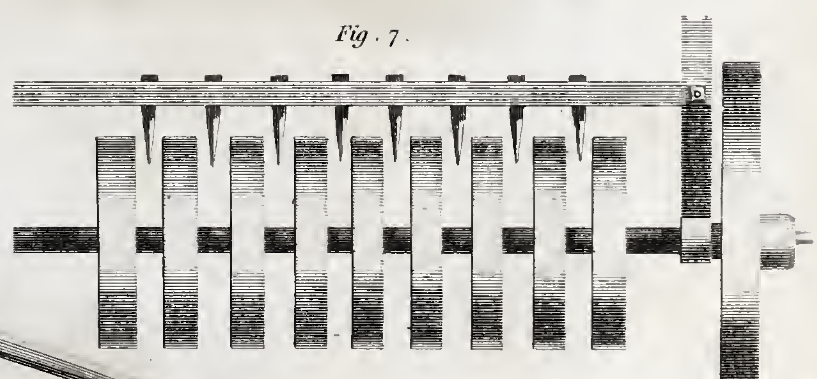
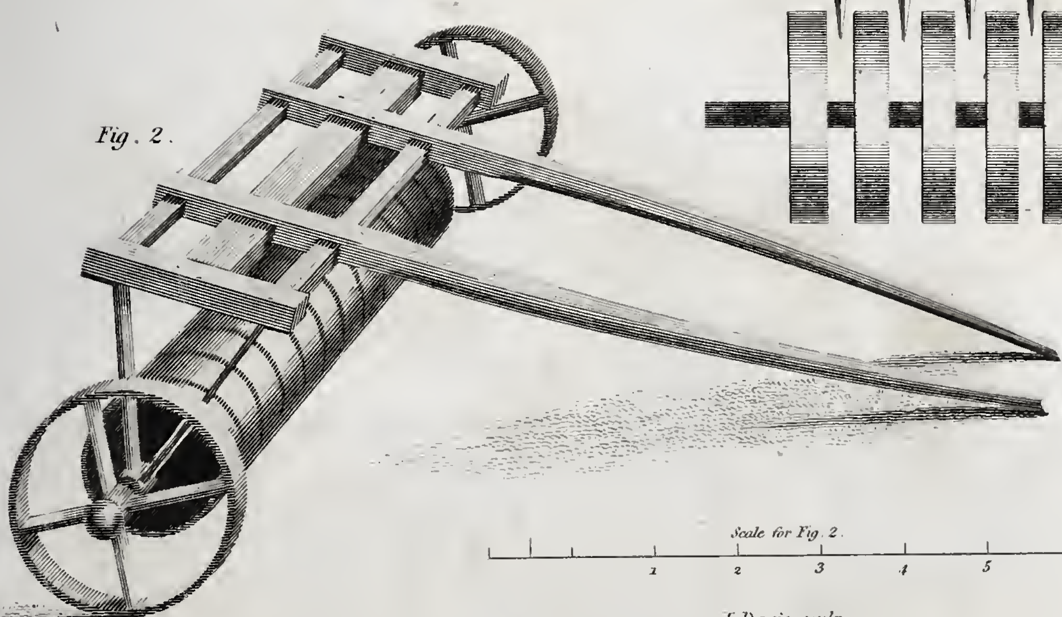


Fig. 2.



Scale for Fig. 2.

1 2 3 4 5 6 feet.

J. Davis sculp.

CATTLE SHEDS,

Fig. 1.

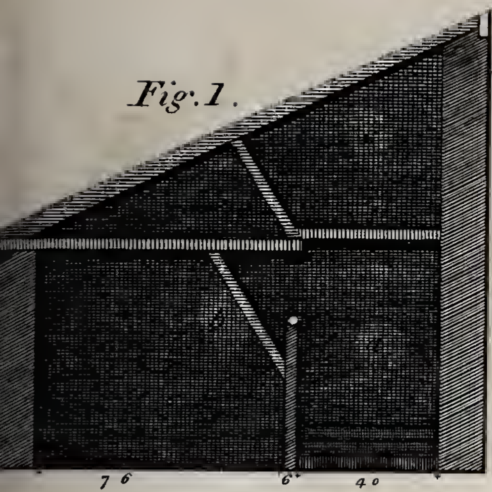


Fig. 2.

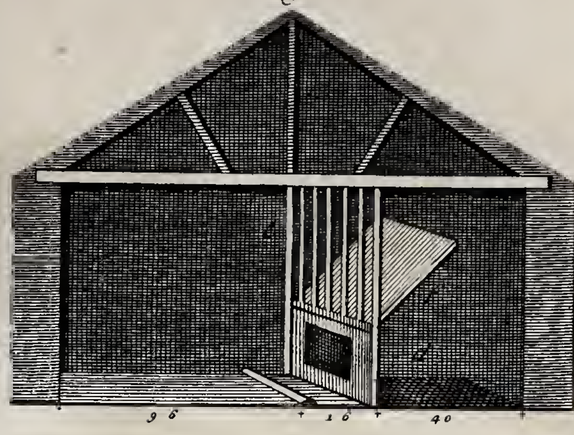


Fig. 5.

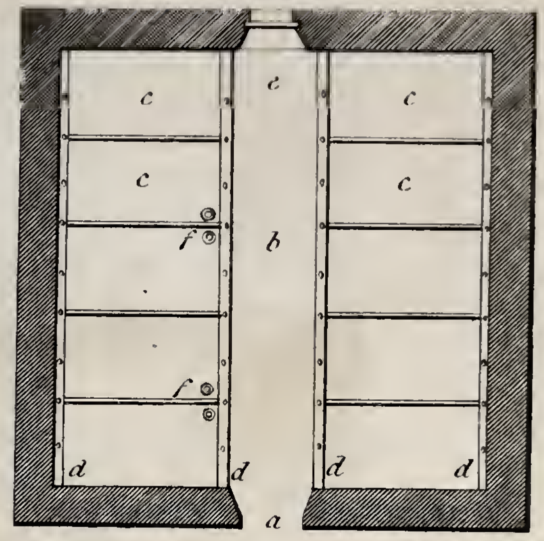


Fig. 6.

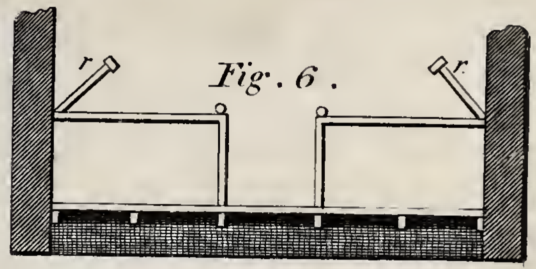


Fig. 3.

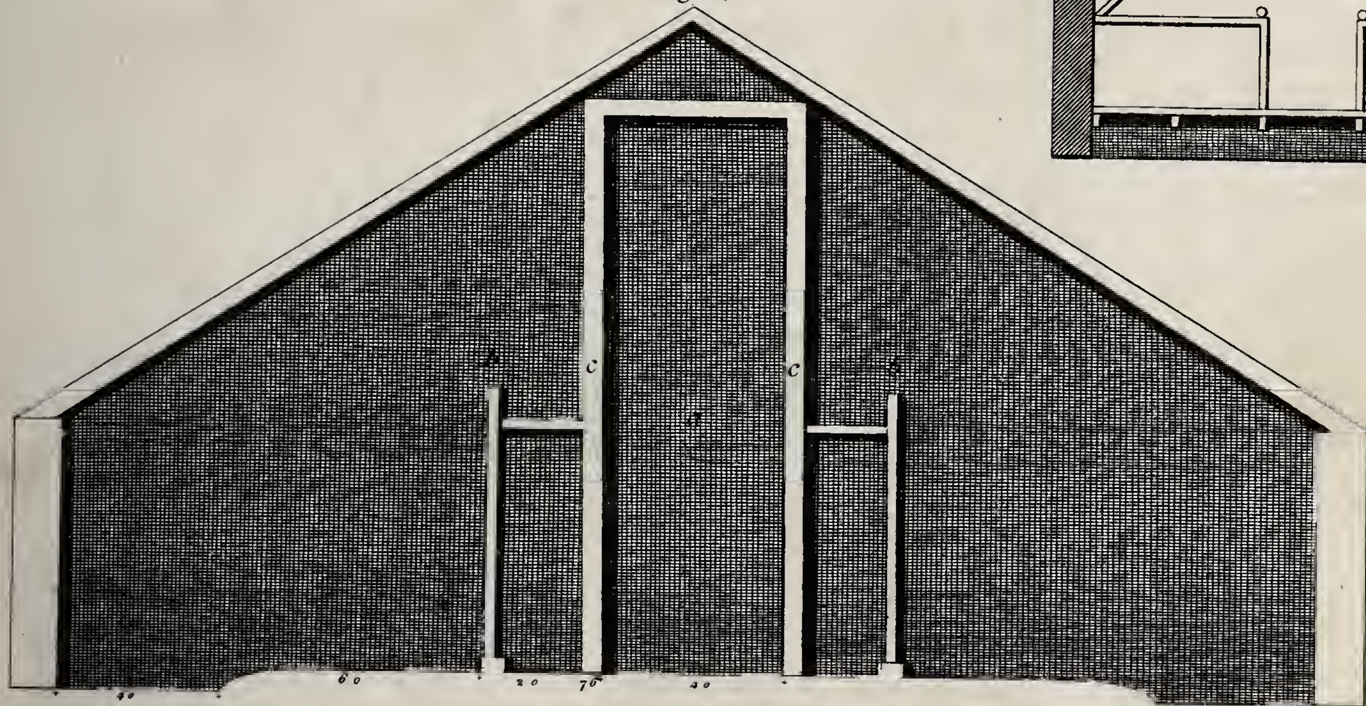
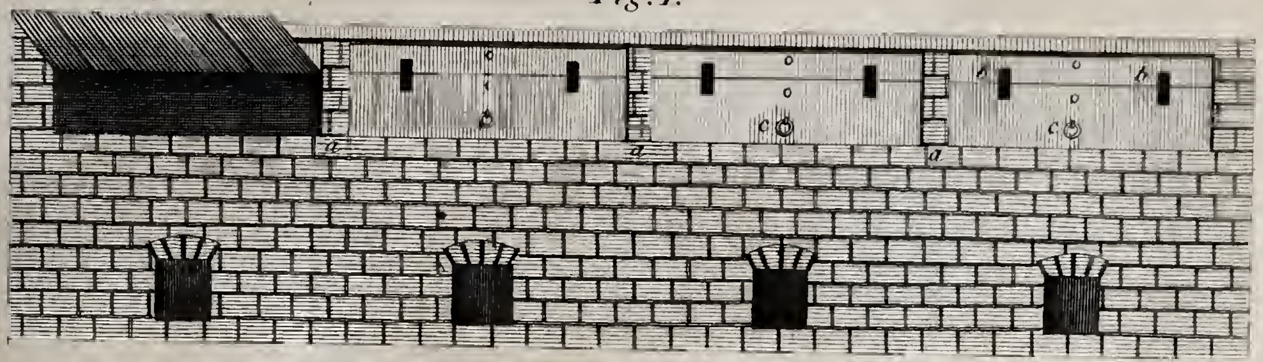


Fig. 4.

INTERNAL PARTS OF CATTLE SHEDS.

Fig. 1.



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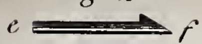
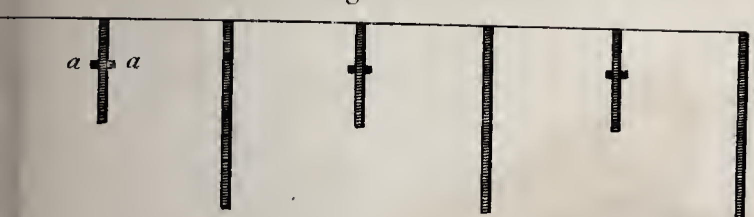


Fig. 3.



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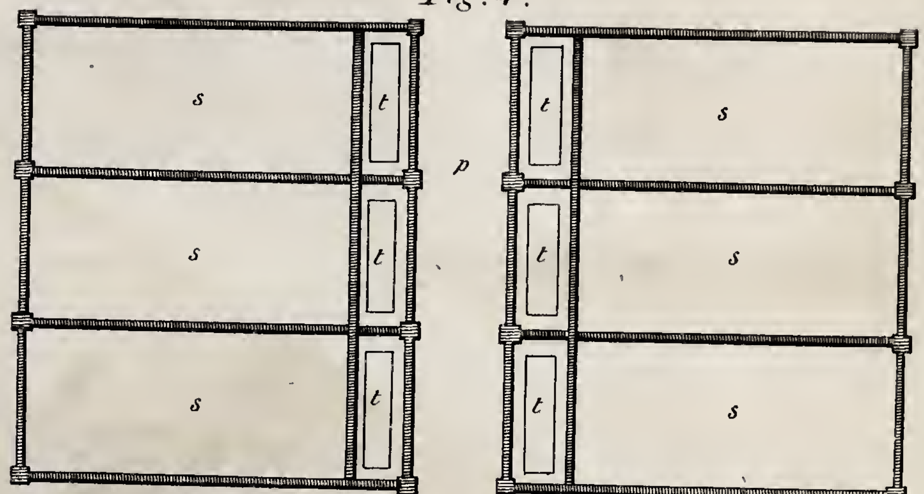

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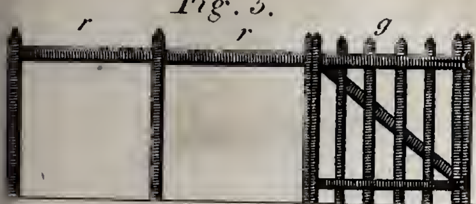

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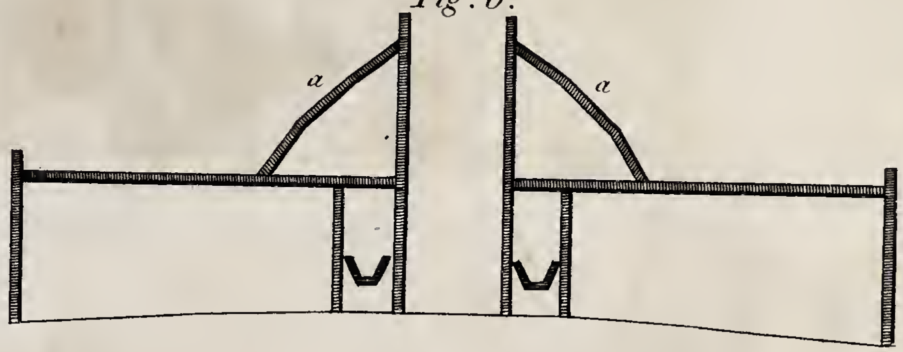


Fig. 7.

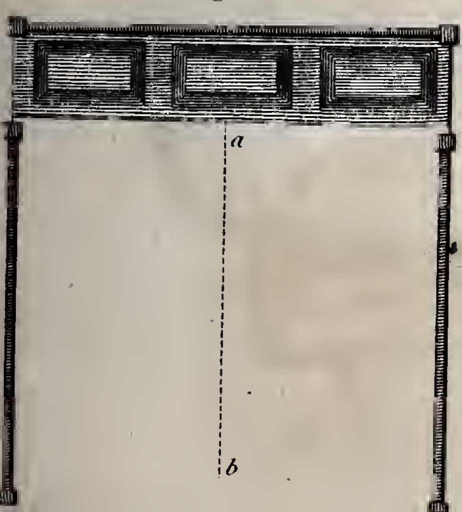
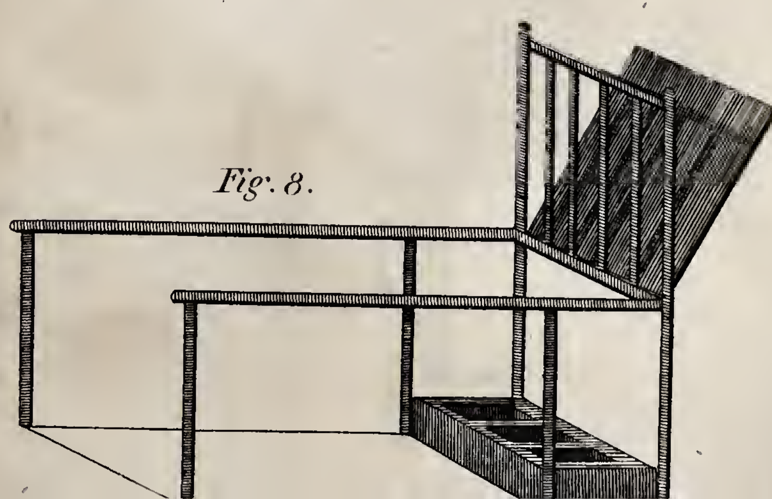


Fig. 8.



CHAFF CUTTERS.

Fig. 2.

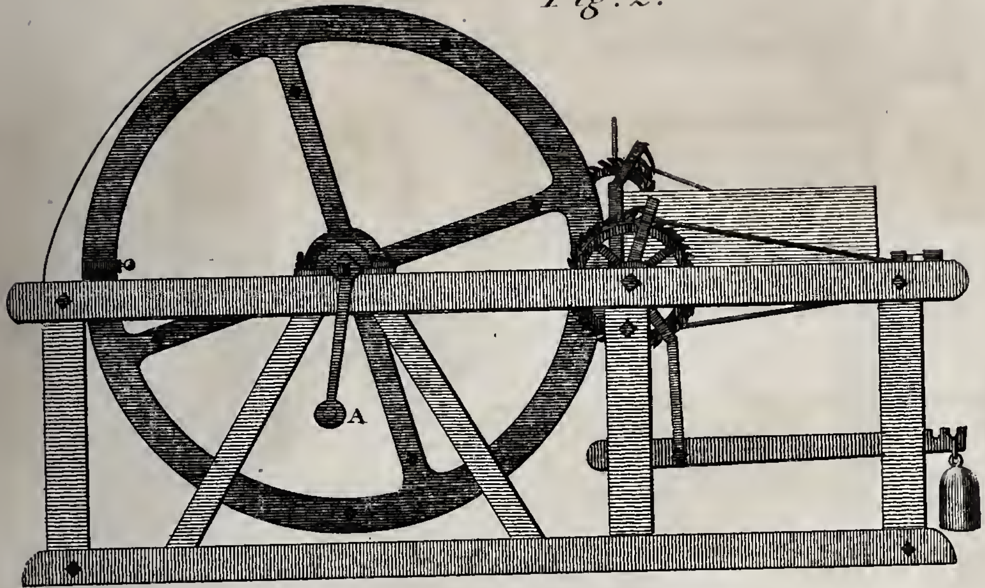
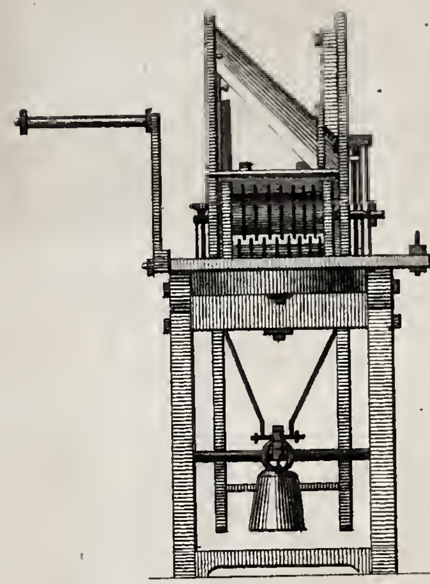


Fig. 3.



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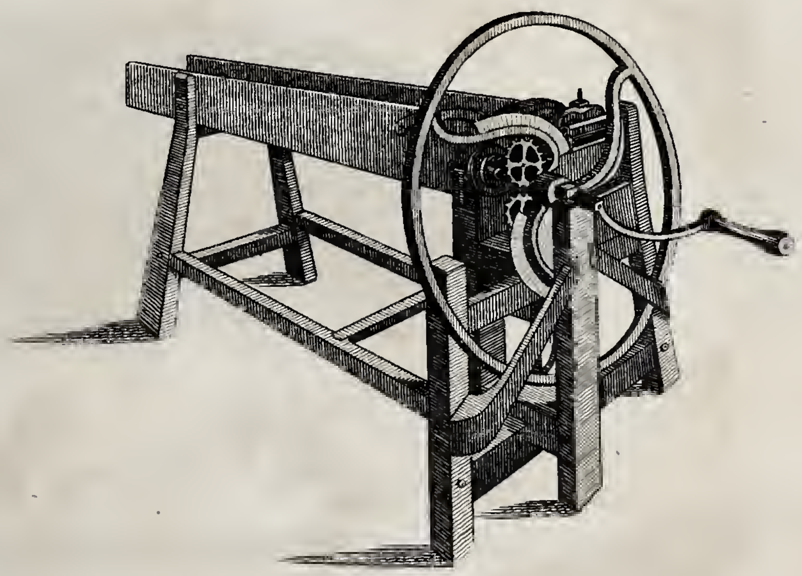
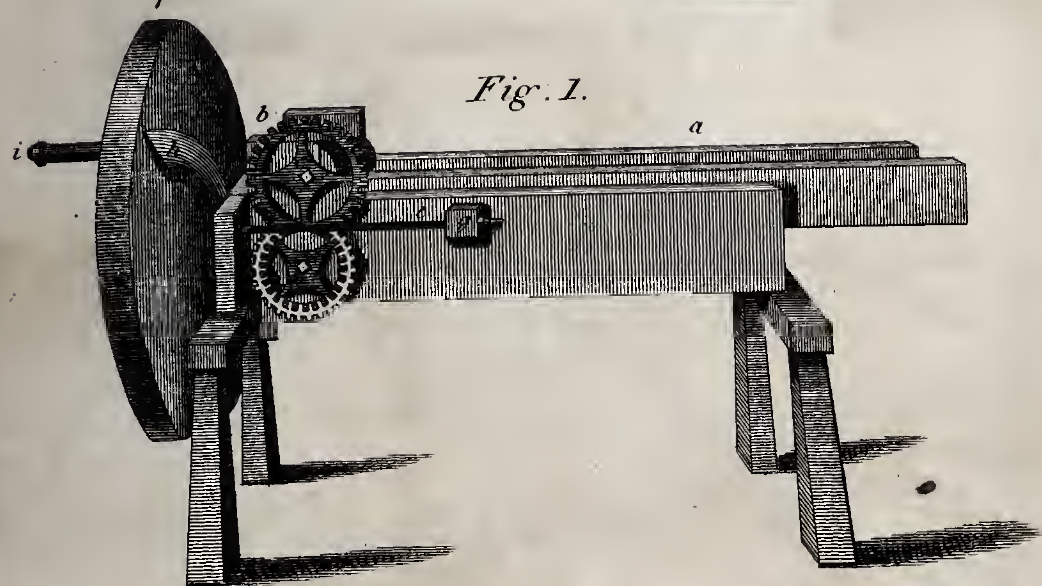
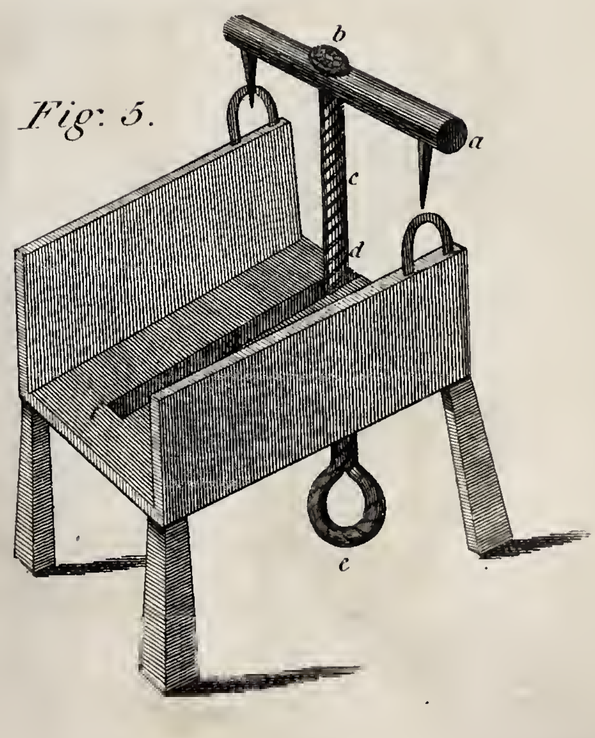


Fig. 1.

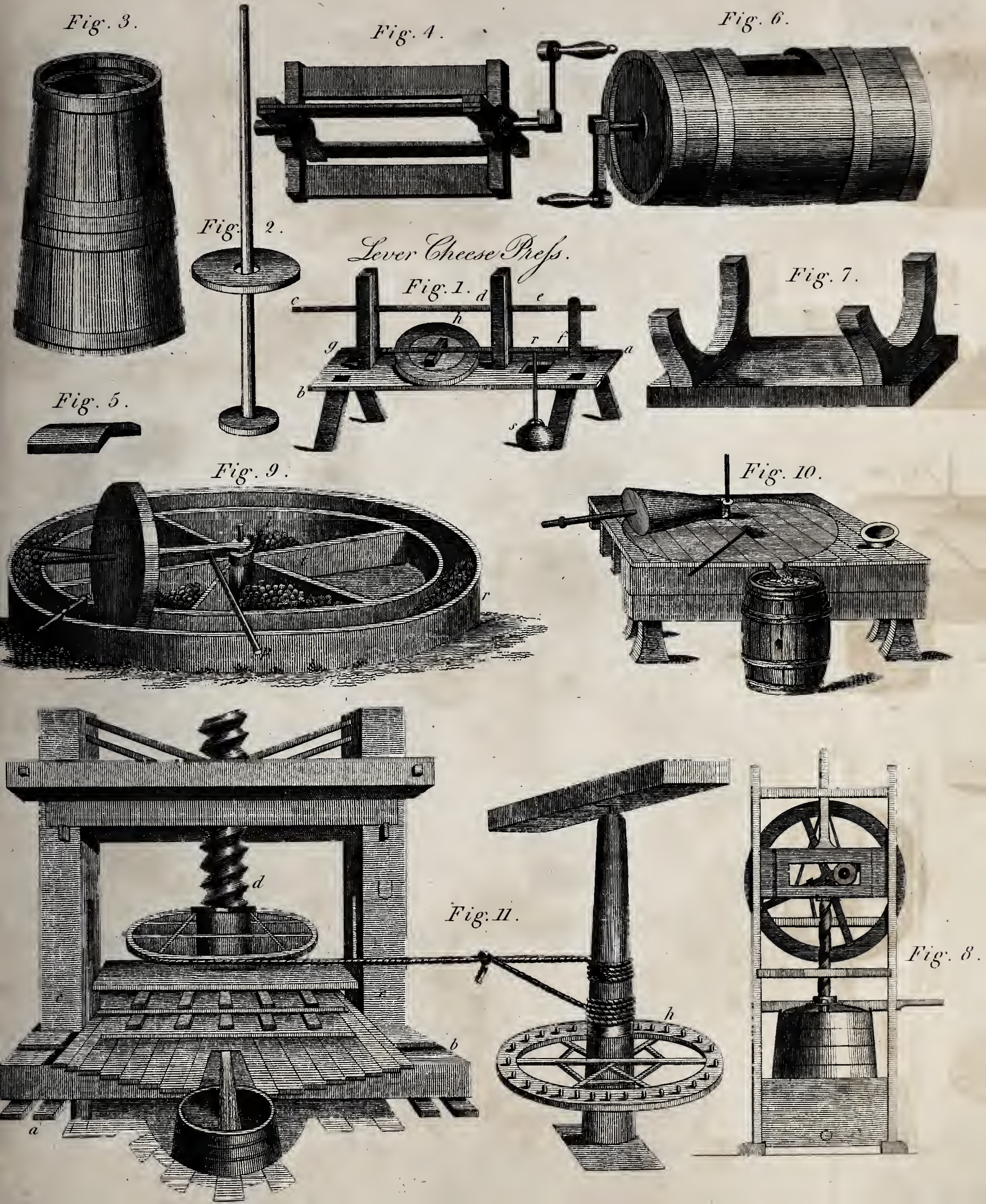


Cutting Box.

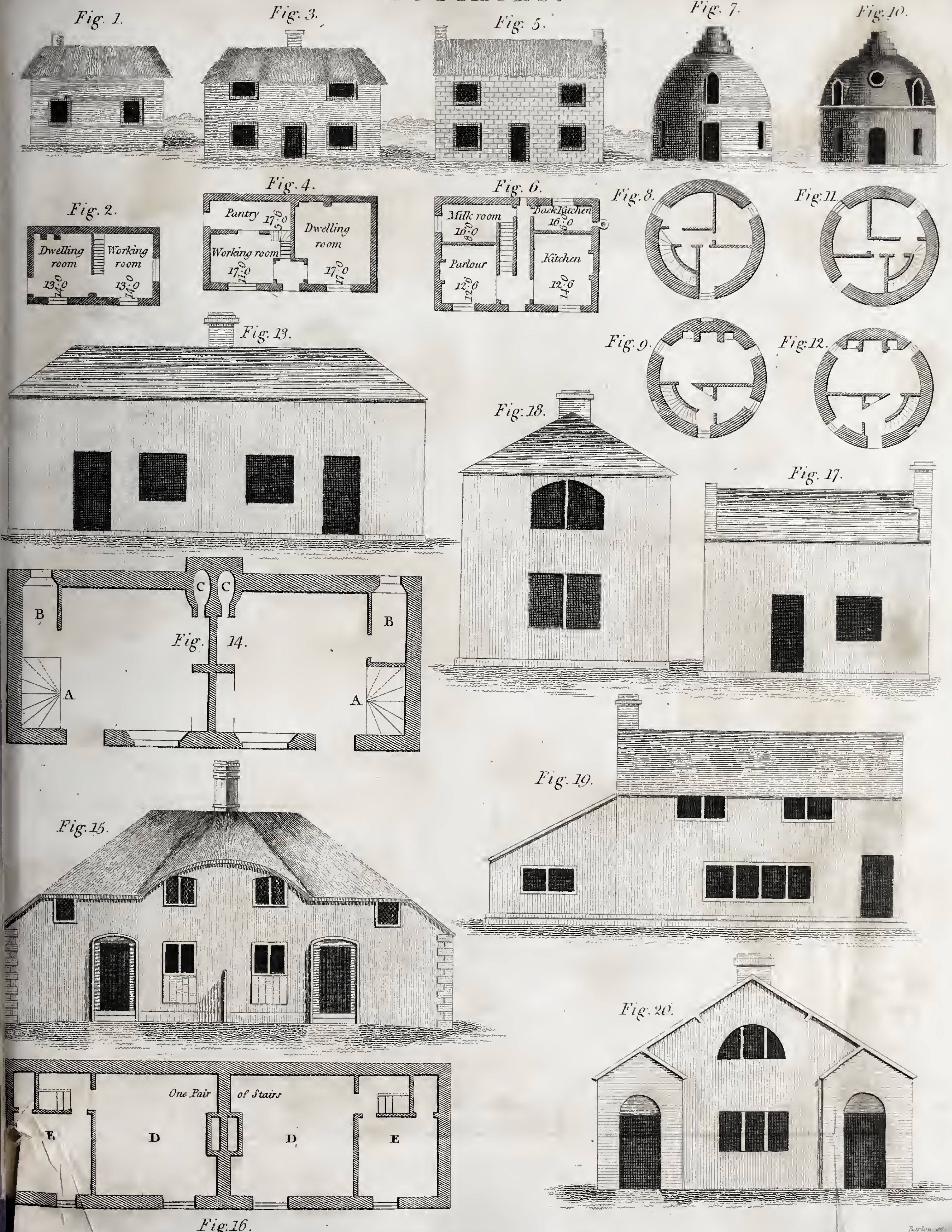
Fig: 5.



CHURNS, CHEESE & CYDER MILL & PRESSES.



COTTAGES.



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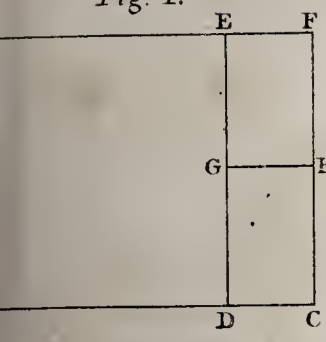
GROUND PLANS OF COTTAGES.

Fig. 1.



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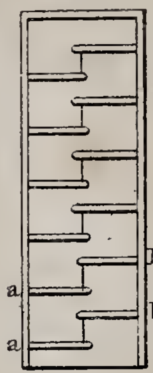

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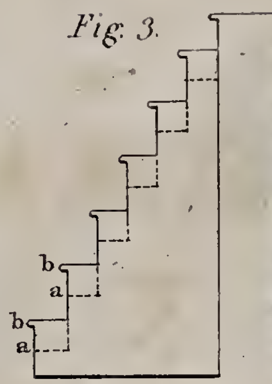

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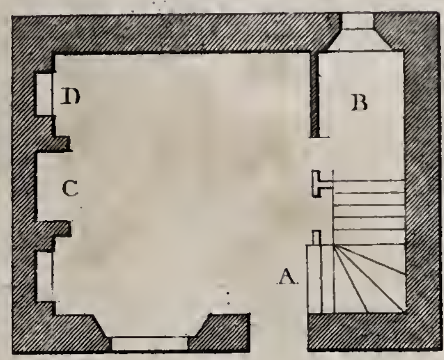
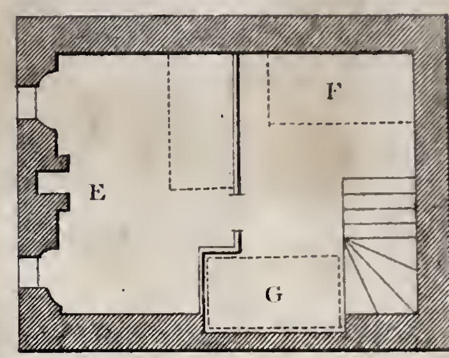


Fig. 5.



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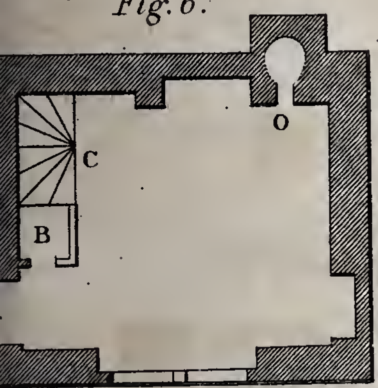


Fig. 7.

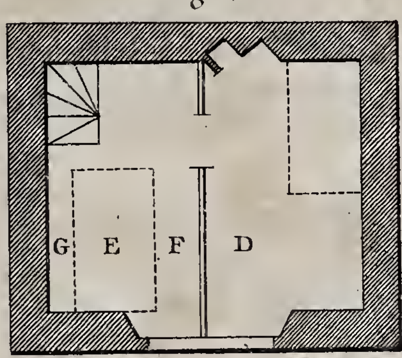


Fig. 8.

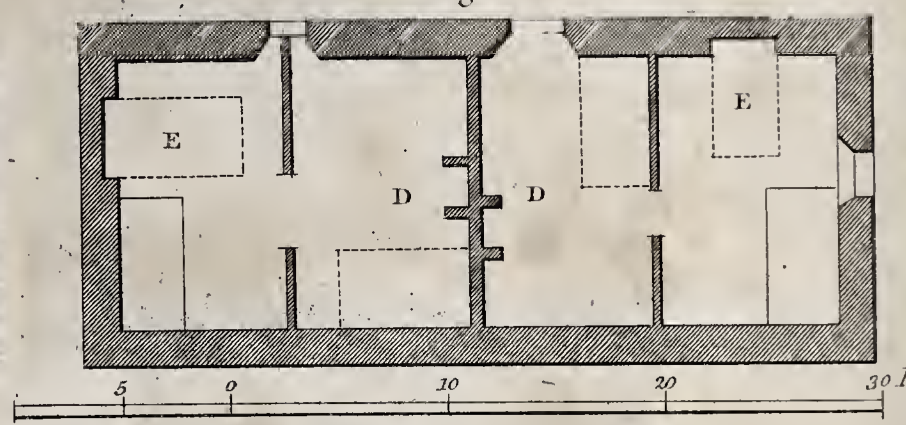


Fig. 10.

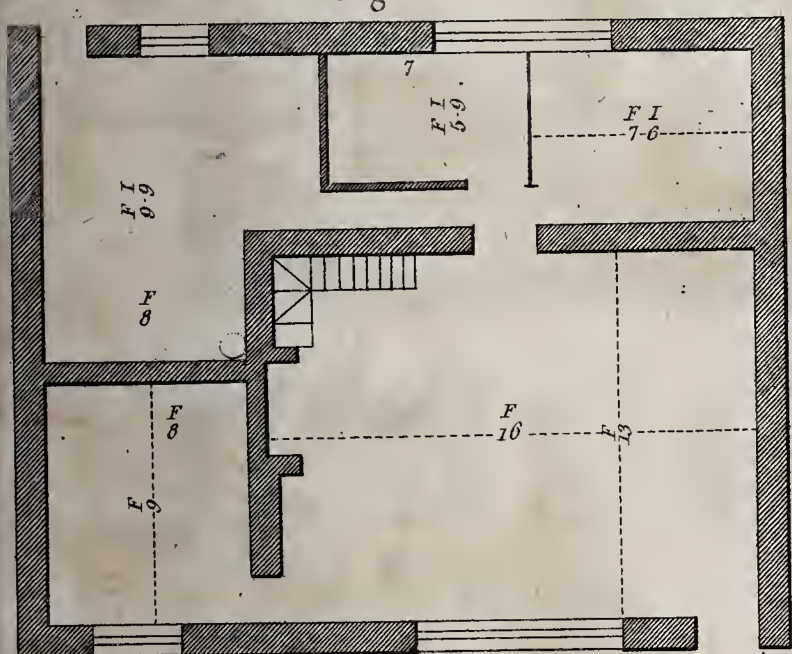


Fig. 11.

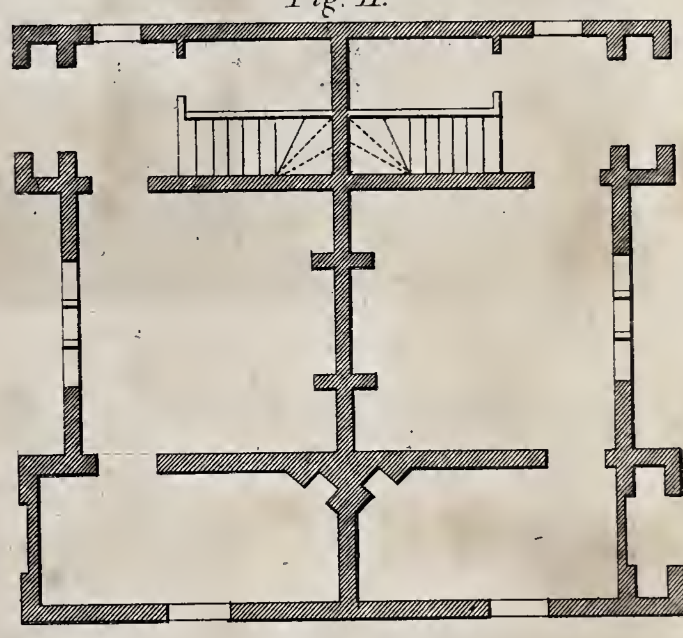


Fig. 9.

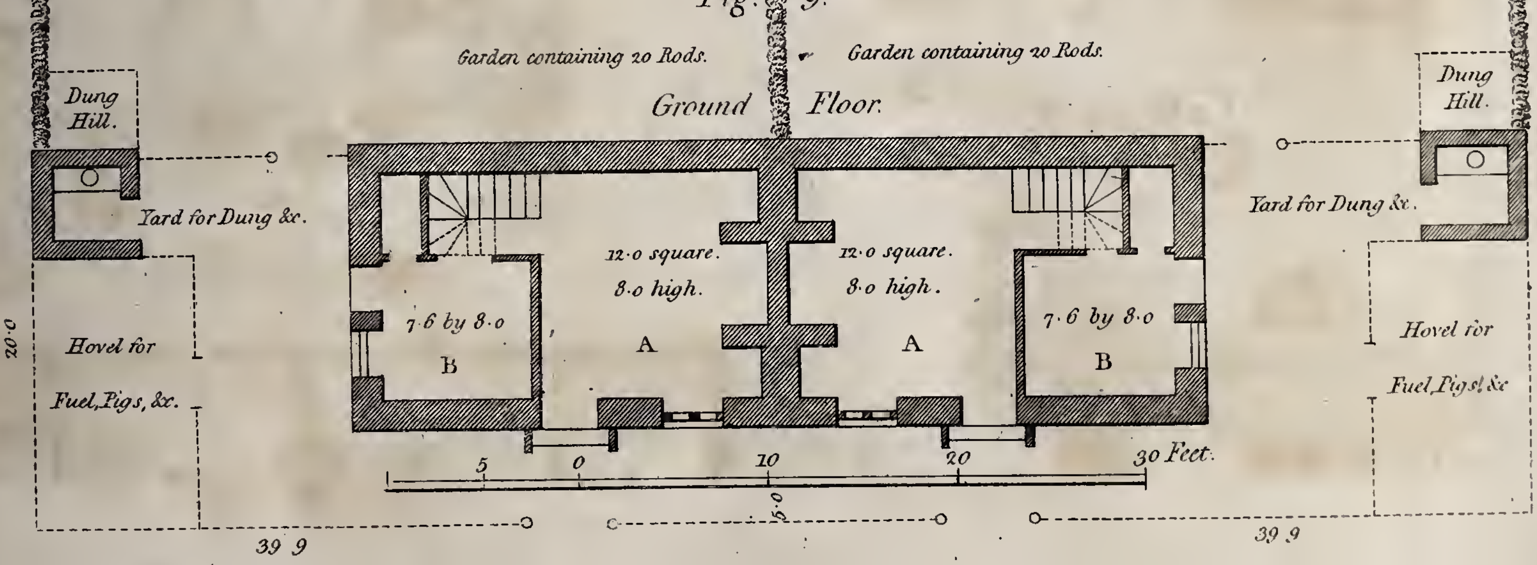


Fig. 2.

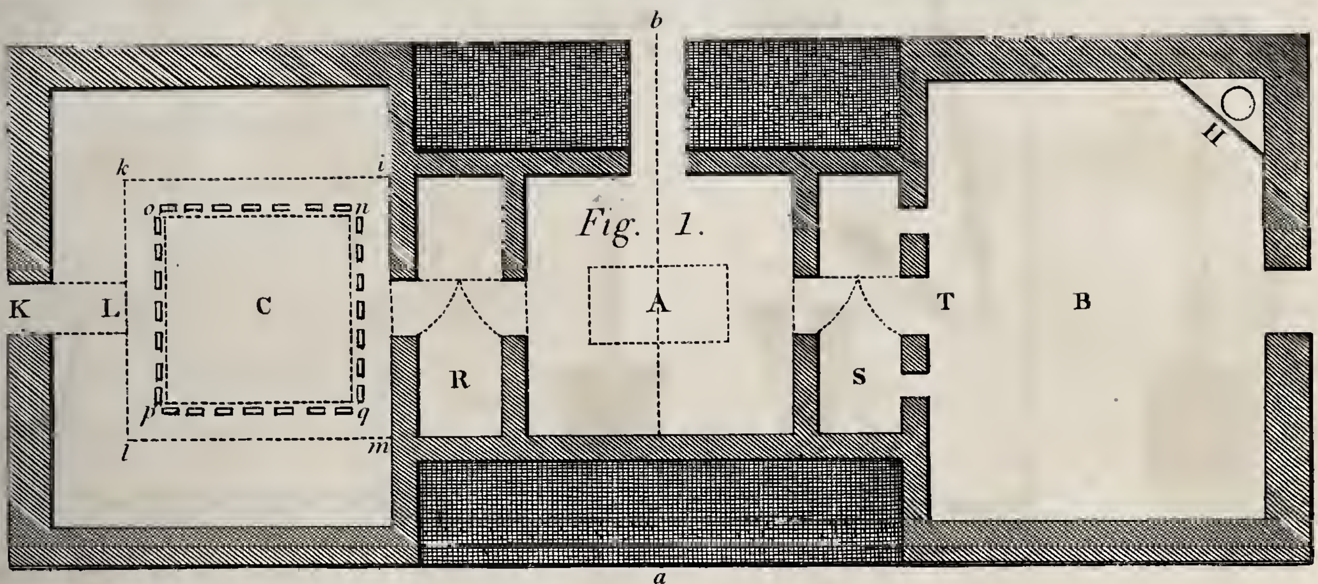
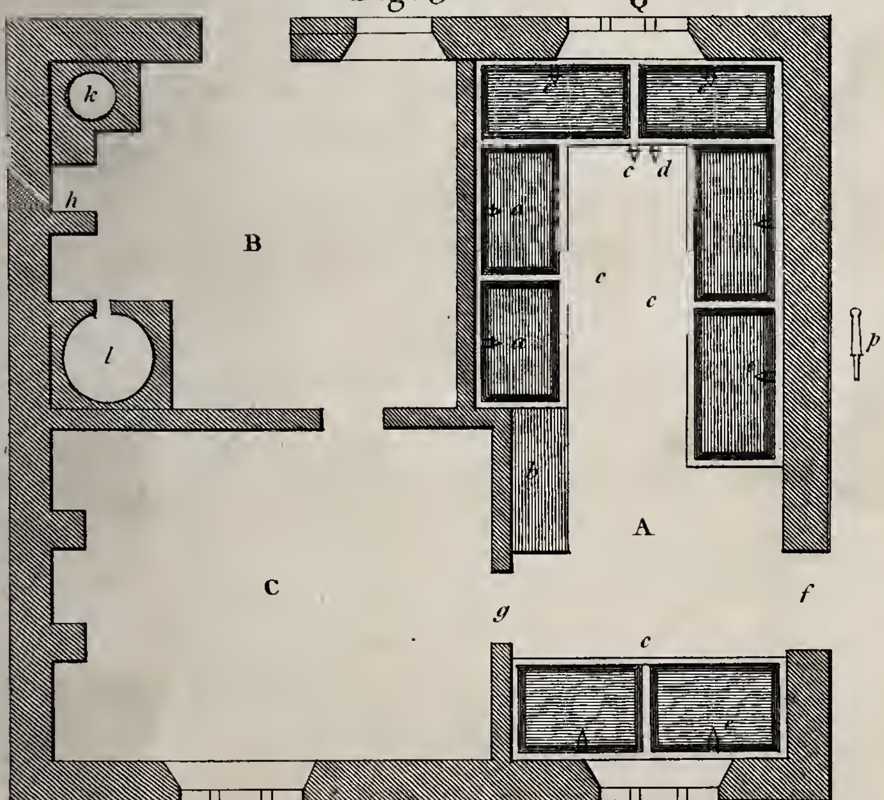


Fig. 1.

Fig. 3.



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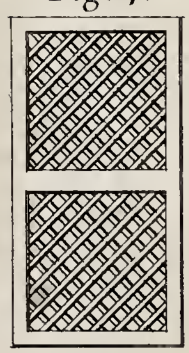

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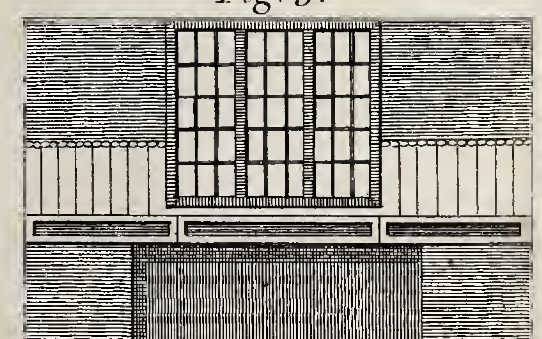

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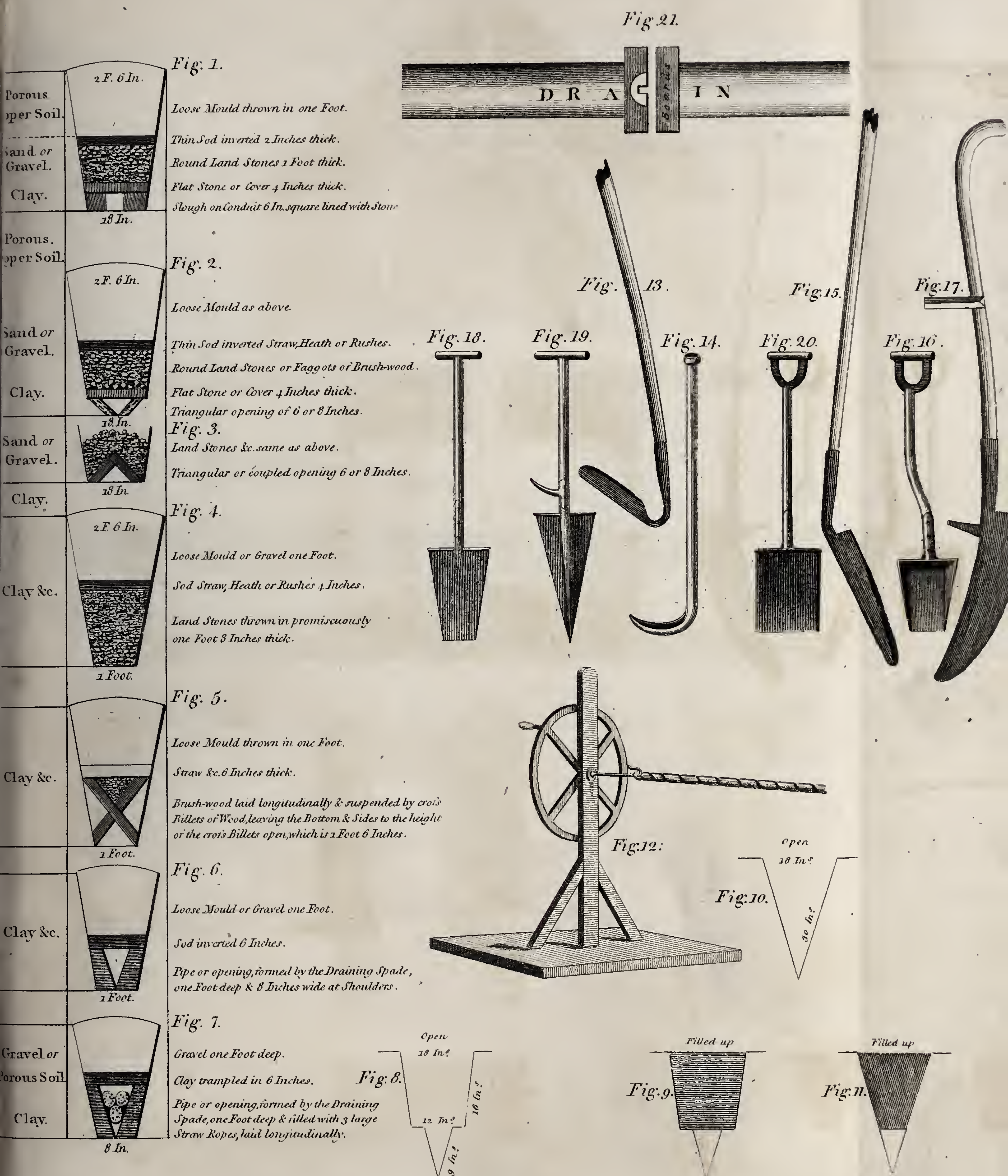
SECTIONS of UNDER-DRAINS.



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DRAINING.

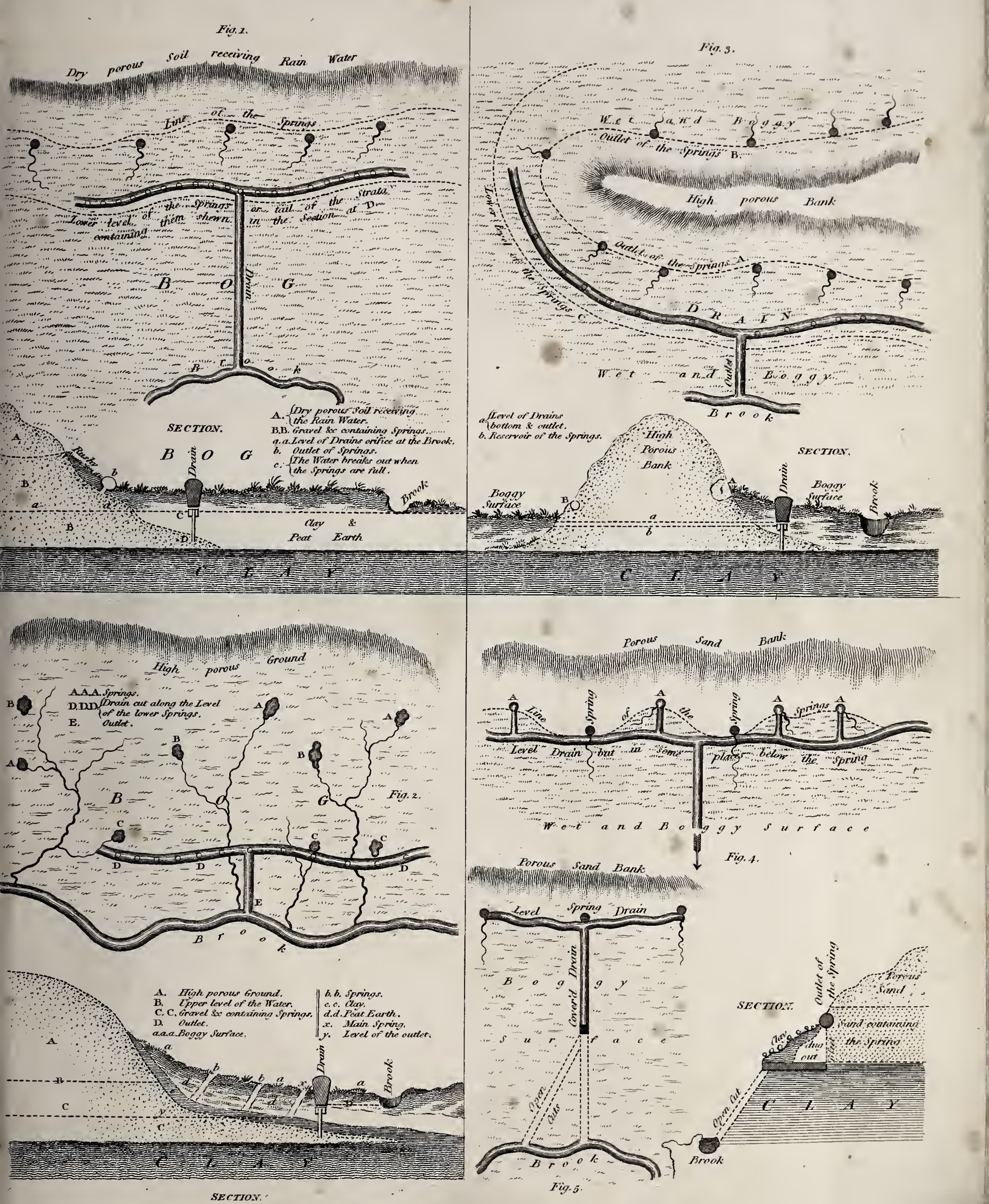


Fig. 1.
Dry porous Soil receiving Rain Water
Line of the Springs
Lower level of the Springs or tail of the Strata containing them shewn in the Section at D.
B O G
Drain
Brook
SECTION.
A. Dry porous Soil receiving the Rain Water.
B.B. Gravel &c containing Springs.
a.a. Level of Drains orifice at the Brook.
b. Outlet of Springs.
c. The Water breaks out when the Springs are full.
B O G
Drain
Brook
Rushes
Clay & Peat Earth
C L A Y
Fig. 3.
Wet and Boggy
Outlet of the Springs B.
High porous Bank
Outlet of the Springs A
Lower level of the Springs C
D R A I N
Outlet
Wet and Boggy
Brook
a. Level of Drains bottom & outlet.
b. Reservoir of the Springs.
High Porous Bank
SECTION.
Boggy Surface
Drain
Boggy Surface
Brook
C L A Y
High porous Ground
A.A.A. Springs.
D.D.D. Drain cut along the Level of the lower Springs.
E. Outlet.
B O G
Fig. 2.
Brook
A. High porous Ground.
B. Upper level of the Water.
C. C. Gravel &c containing Springs.
D. Outlet.
a.a.a. Boggy Surface.
b.b. Springs.
c.c. Clay.
d.d. Peat Earth.
x. Main Spring.
y. Level of the outlet.
Drain
Brook
C L A Y
SECTION.
Porous Sand Bank
Line of the Springs
Spring
Spring
Level Drain but in some places below the Spring
Wet and Boggy Surface
Fig. 4.
Porous Sand Bank
Level Spring Drain
Boggy Surface
Cover'd Drain
Open Cuts
Brook
Fig. 5.
SECTION.
Outlet of the Spring
Porous Sand
Sand containing the Spring
Clay
dug out
Open Cut
C L A Y
Brook

DRAINING.

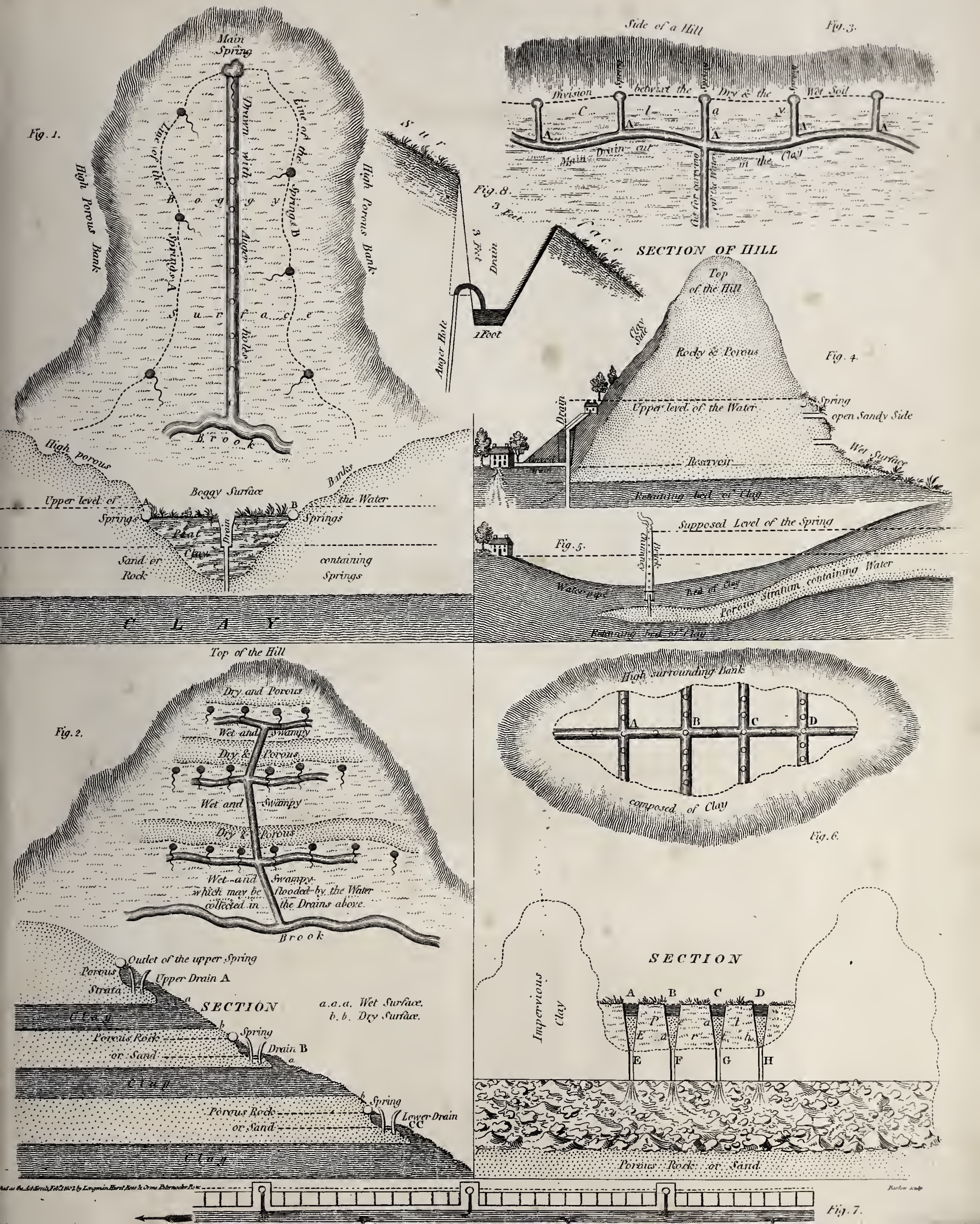


Fig. 1.
Main Spring
Drawn with Auger holes
Line of the Springs A
Line of the Springs B
B o g g y
S u r f a c e
High Porous Bank
High Porous Bank
Brook
High porous Banks
Boggy Surface
Upper level of the Water
A Springs
B Springs
Peat
Clay
Drain
Sand or Rock containing Springs
C L A Y
Side of a Hill
Fig. 3.
Division betwixt the Dry & the Wet Soil
C l a y
Main Drain cut in the Clay
Fig. 8.
3 Feet
Surface
Drain
1 Foot
Auger Hole
SECTION OF HILL
Top of the Hill
Clay Side
Rocky & Porous
Fig. 4.
Spring
open Sandy Side
Upper level of the Water
Drain
Wet Surface
Reservoir
Retaining bed of Clay
Supposed Level of the Spring
Fig. 5.
Brick Chimney
Water pipe
Bed of Clay
Porous Stratum containing Water
Retaining bed of Clay
Top of the Hill
Fig. 2.
Dry and Porous
Wet and Swampy
Dry & Porous
Wet and Swampy
Dry & Porous
Wet and Swampy which may be flooded by the Water collected in the Drains above
Brook
Outlet of the upper Spring
Porous Strata
Upper Drain A
SECTION
a. a. a. Wet Surface.
b. b. Dry Surface.
Clay
Spring
Porous Rock or Sand
Drain B
Clay
Spring
Porous Rock or Sand
Lower Drain CC
Clay
High surrounding Bank
A B C D
composed of Clay
Fig. 6.
SECTION
Impervious Clay
A B C D
P e a t
E a r t h
E F G H
Porous Rock or Sand
Fig. 7.

Fig. 1.

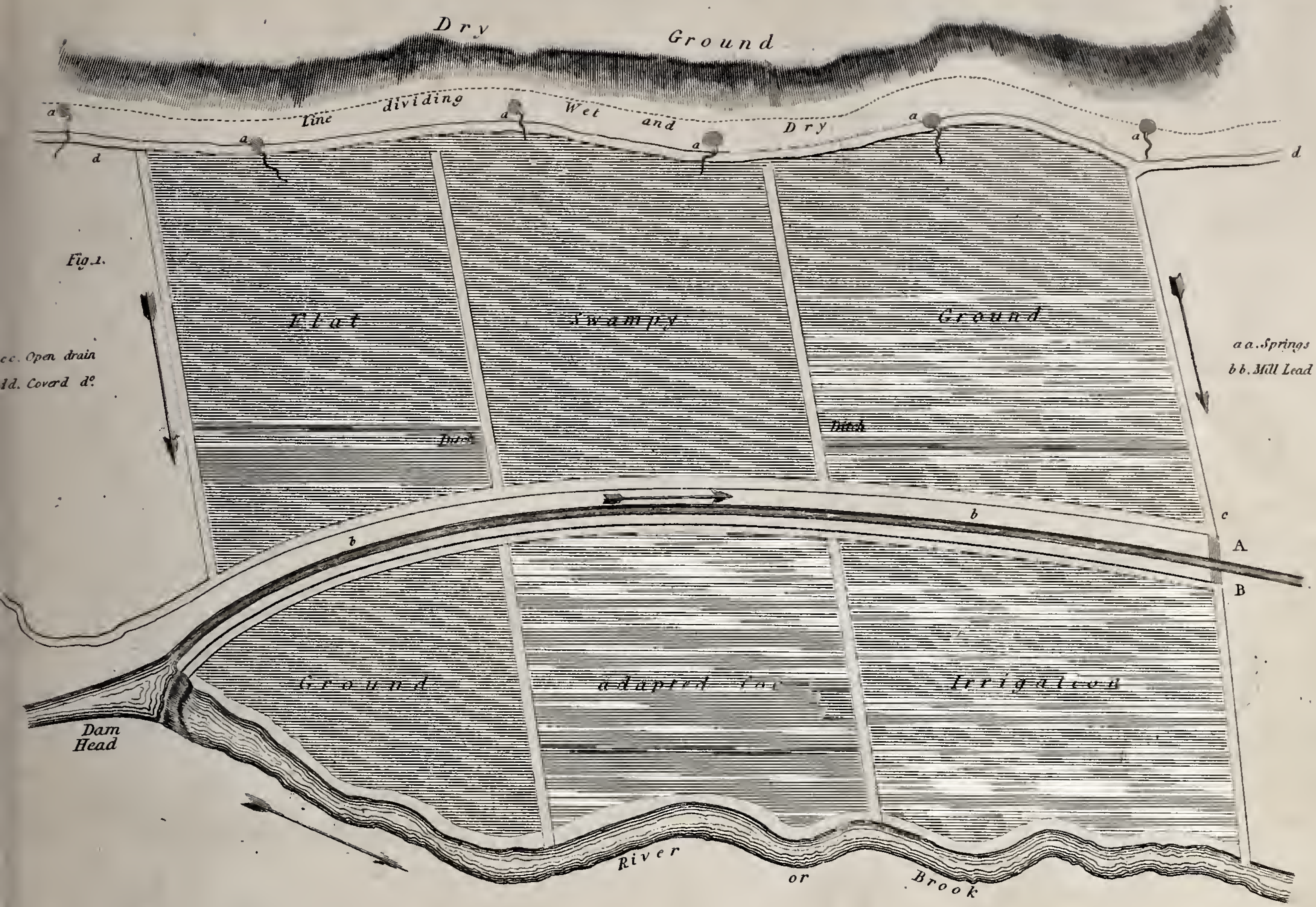


Fig. 2.

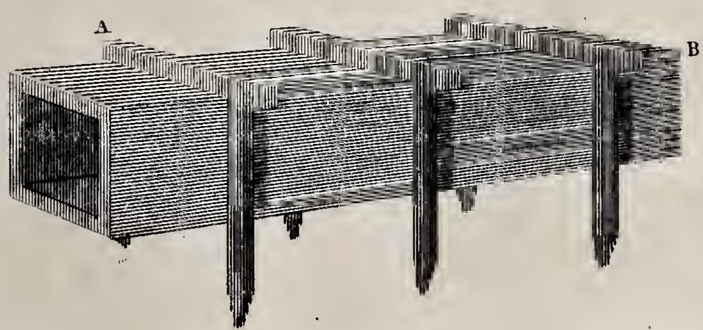
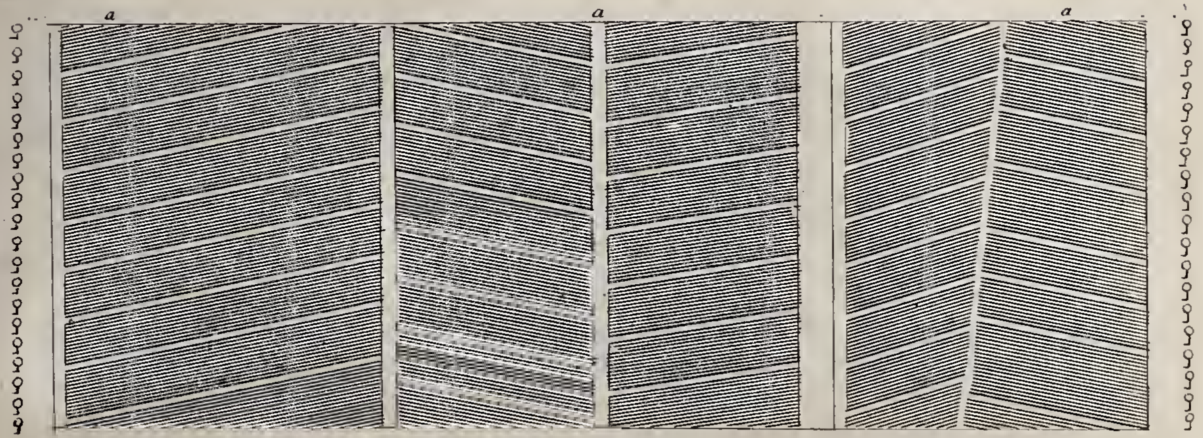


Fig. 3.



Blunt del et sculp.

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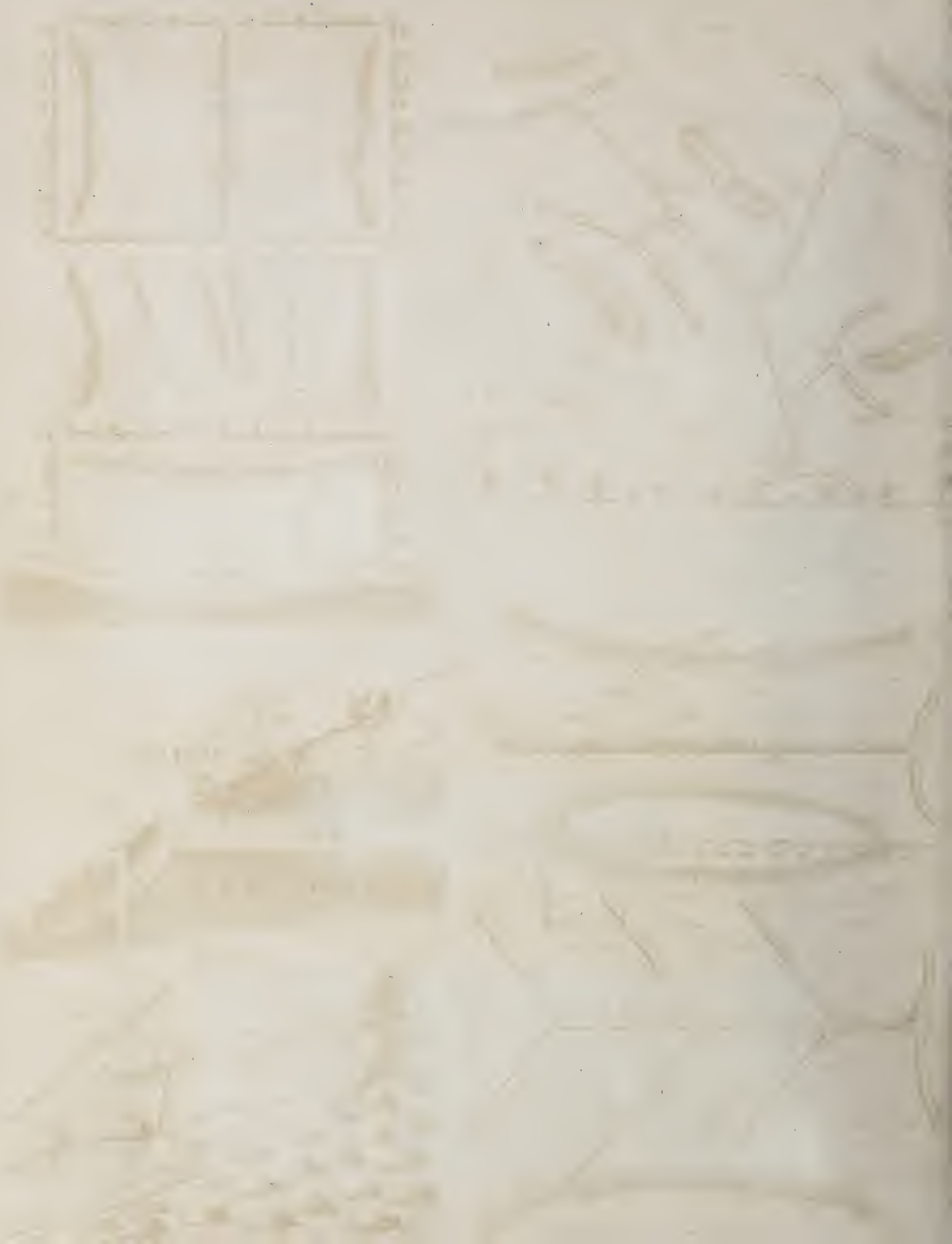


Fig. 1.

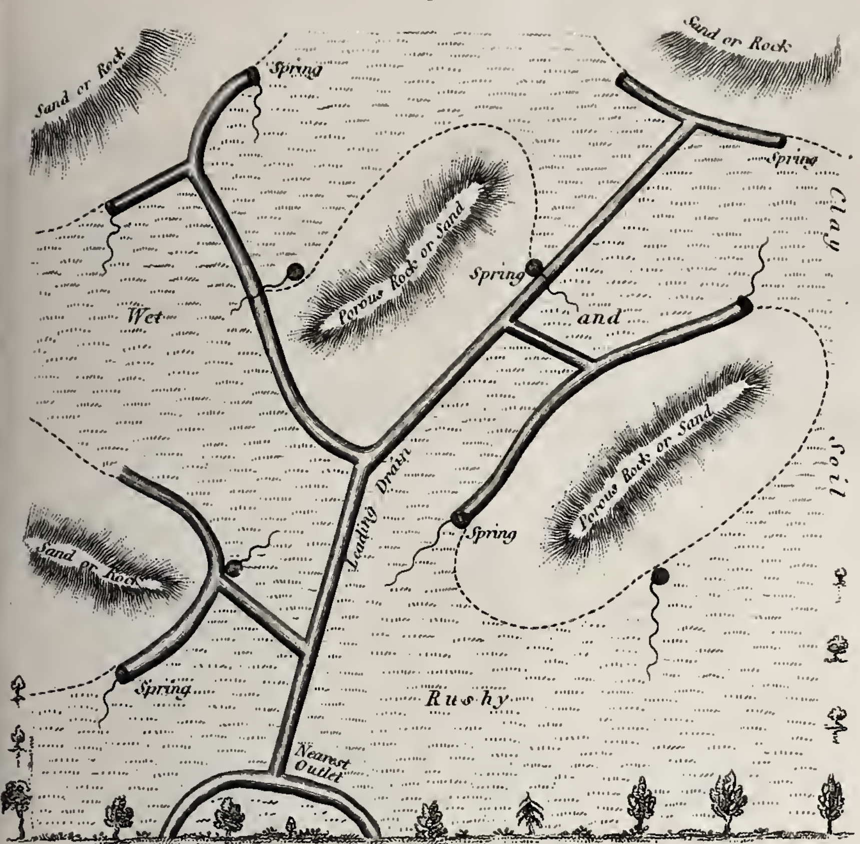
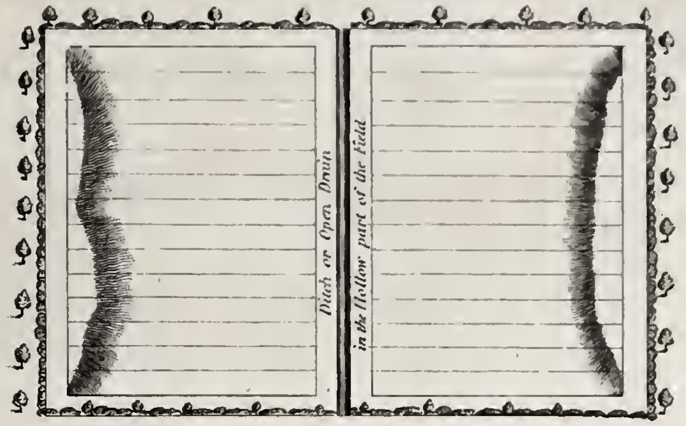
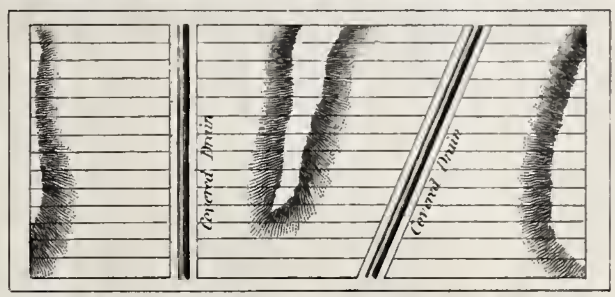


Fig. 4.





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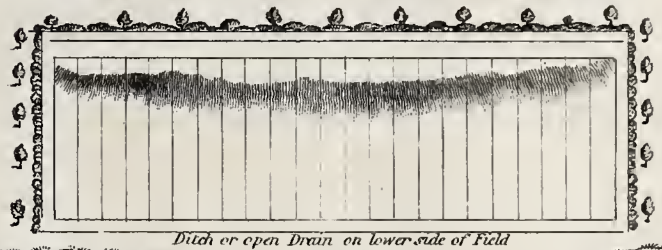

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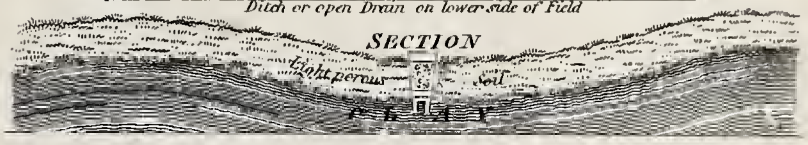

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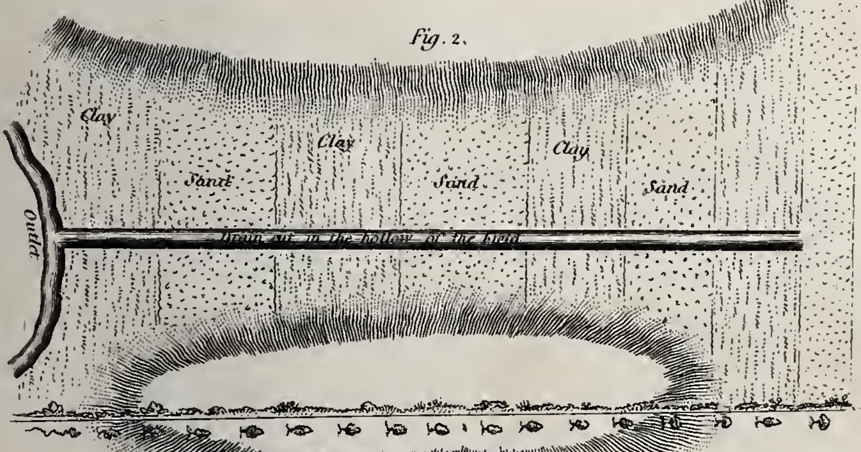

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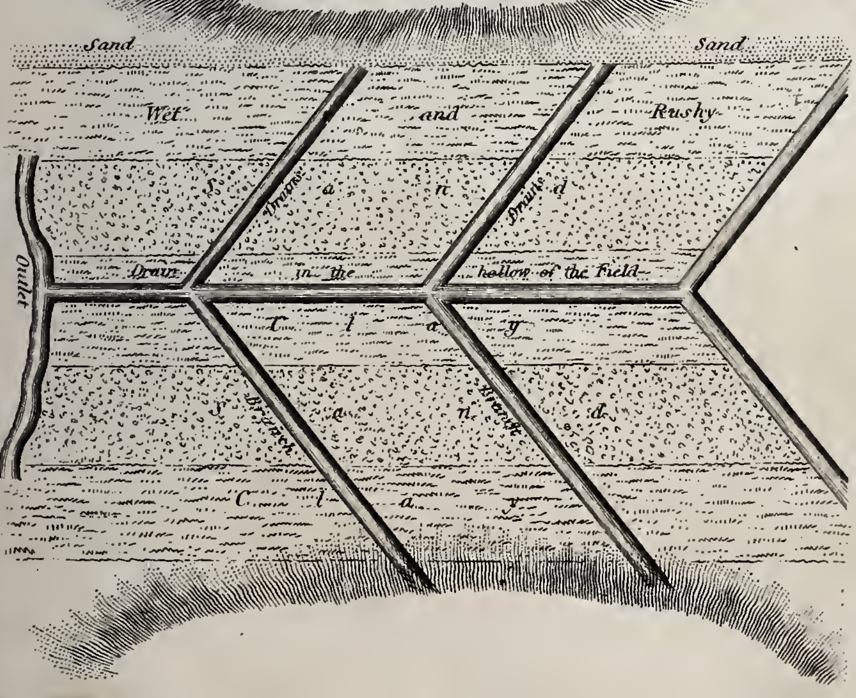


Fig. 7.

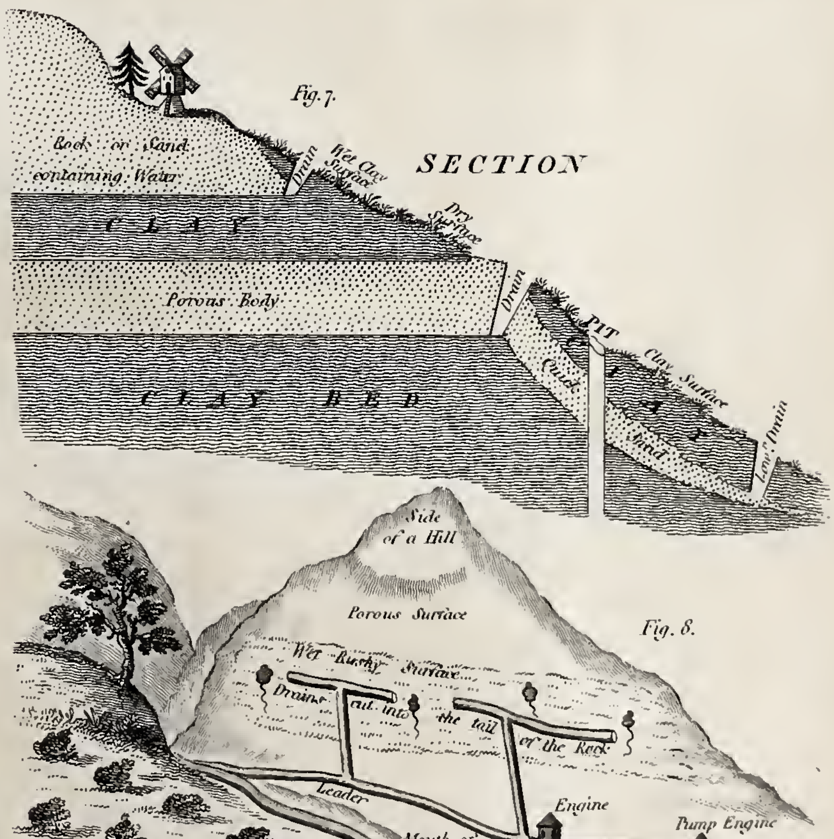


Fig. 8.

DRAINING.

Fig. 3.

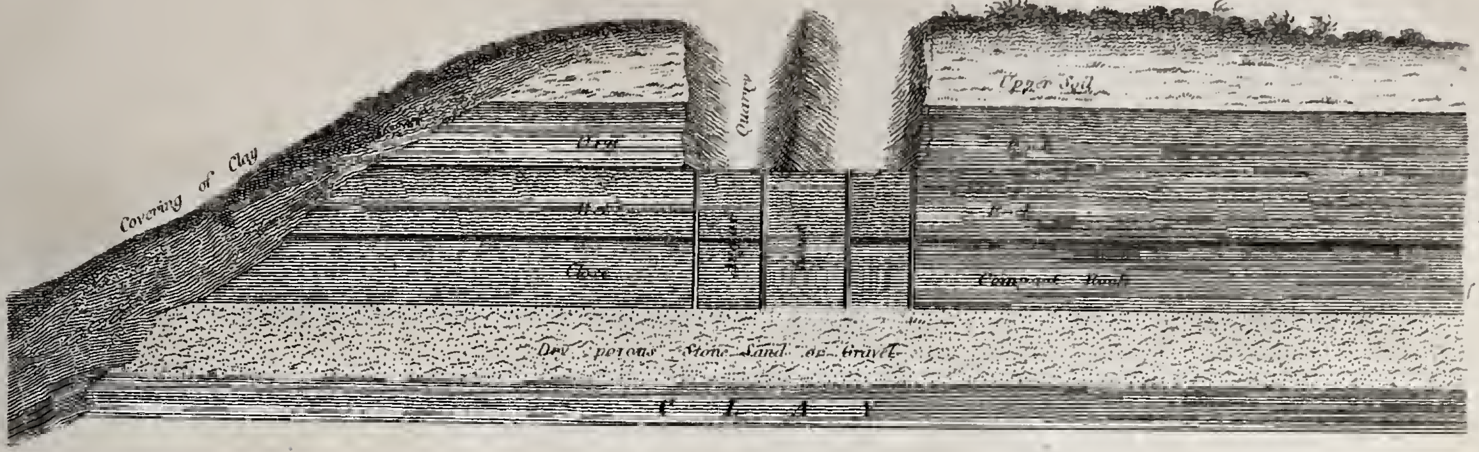
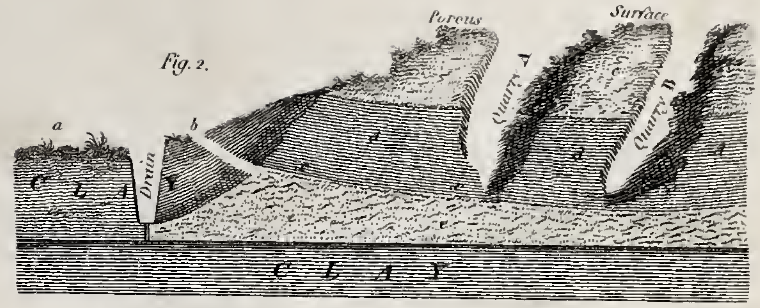


Fig. 1.

a. a. a. Springs or Outlets of part of the Water.
b. b. b. Drain along the tail of the Rock.
c. Drain for carrying off the Water.

Fig. 2.



a. Wet Rushy Surface.
b. Outlet of the Water.
c.c. Upper Soil.
d.d.d. Dry Rock.
e.e. Wet Rock.
x.x. Upper Level of the Water.

Fig. 4.

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Barlow sculp.

DRAINING BRICKS.

Fig. 1.

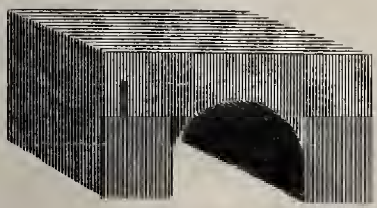


Fig. 2.

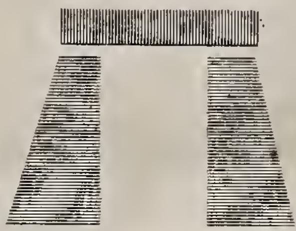
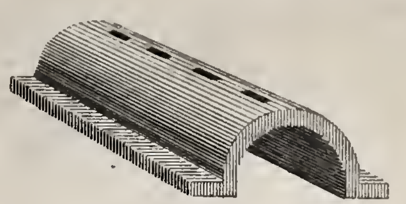


Fig. 3.



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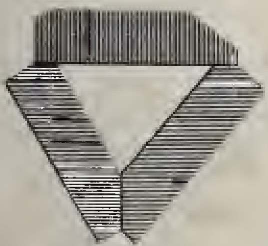

Fig. 5

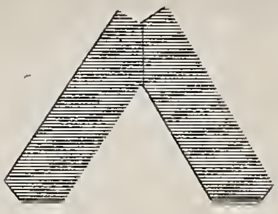

Fig. 6.

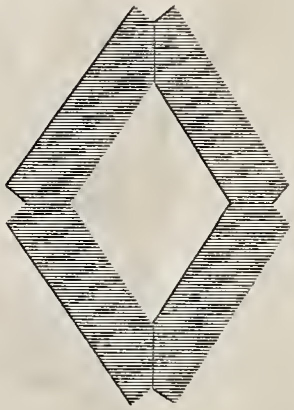

Fig. 7.

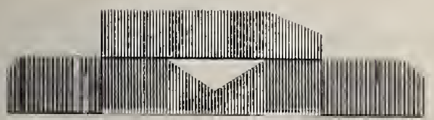

Fig. 8.

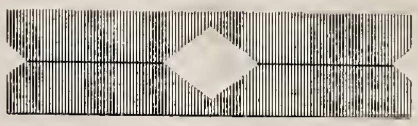

Fig. 9

Fig. 10.

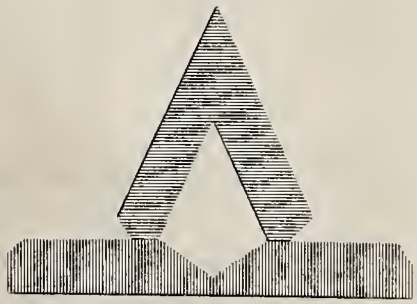

Fig. 11.

Fig. 12.

Fig. 13.

Blunt del et sc.

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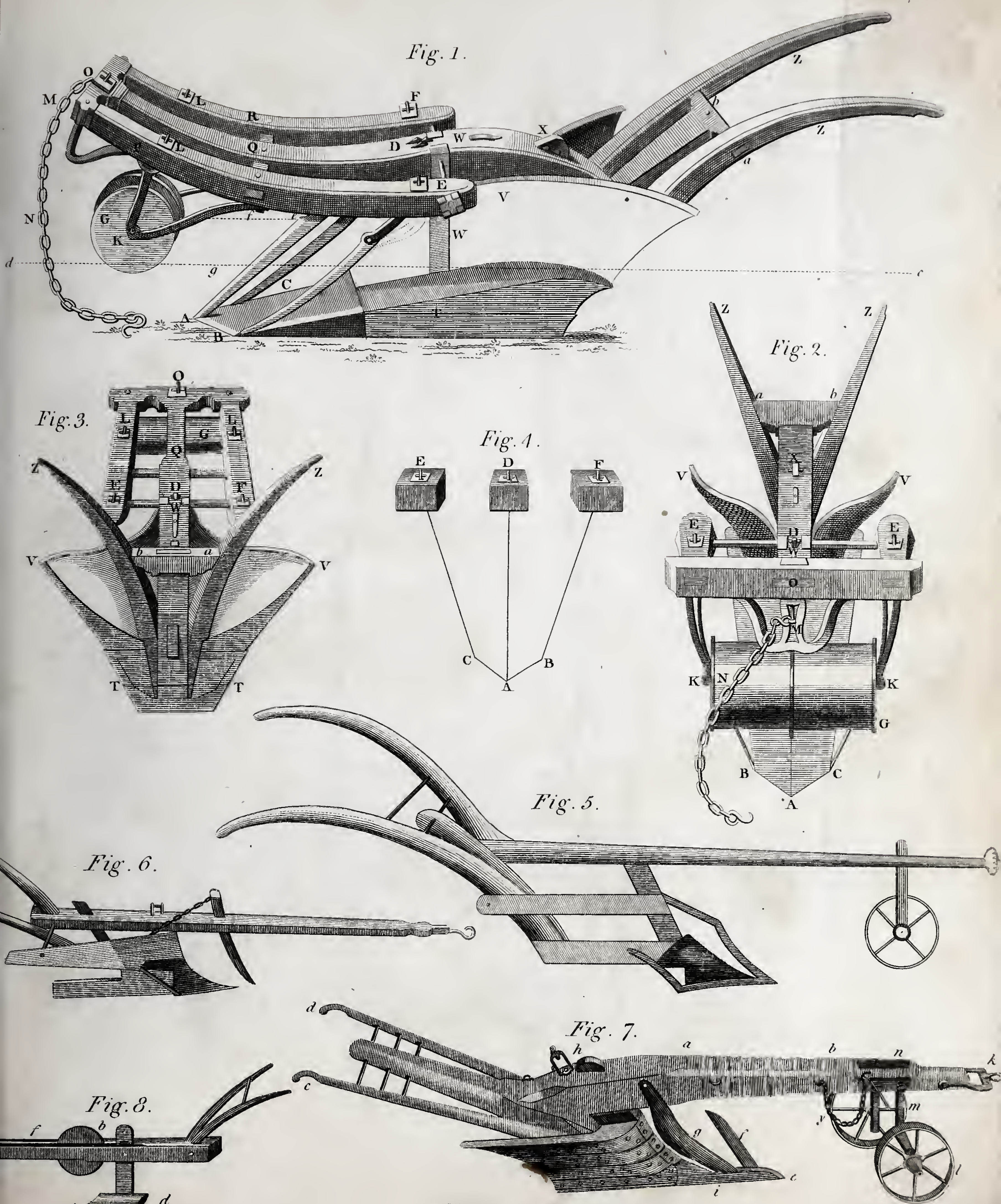
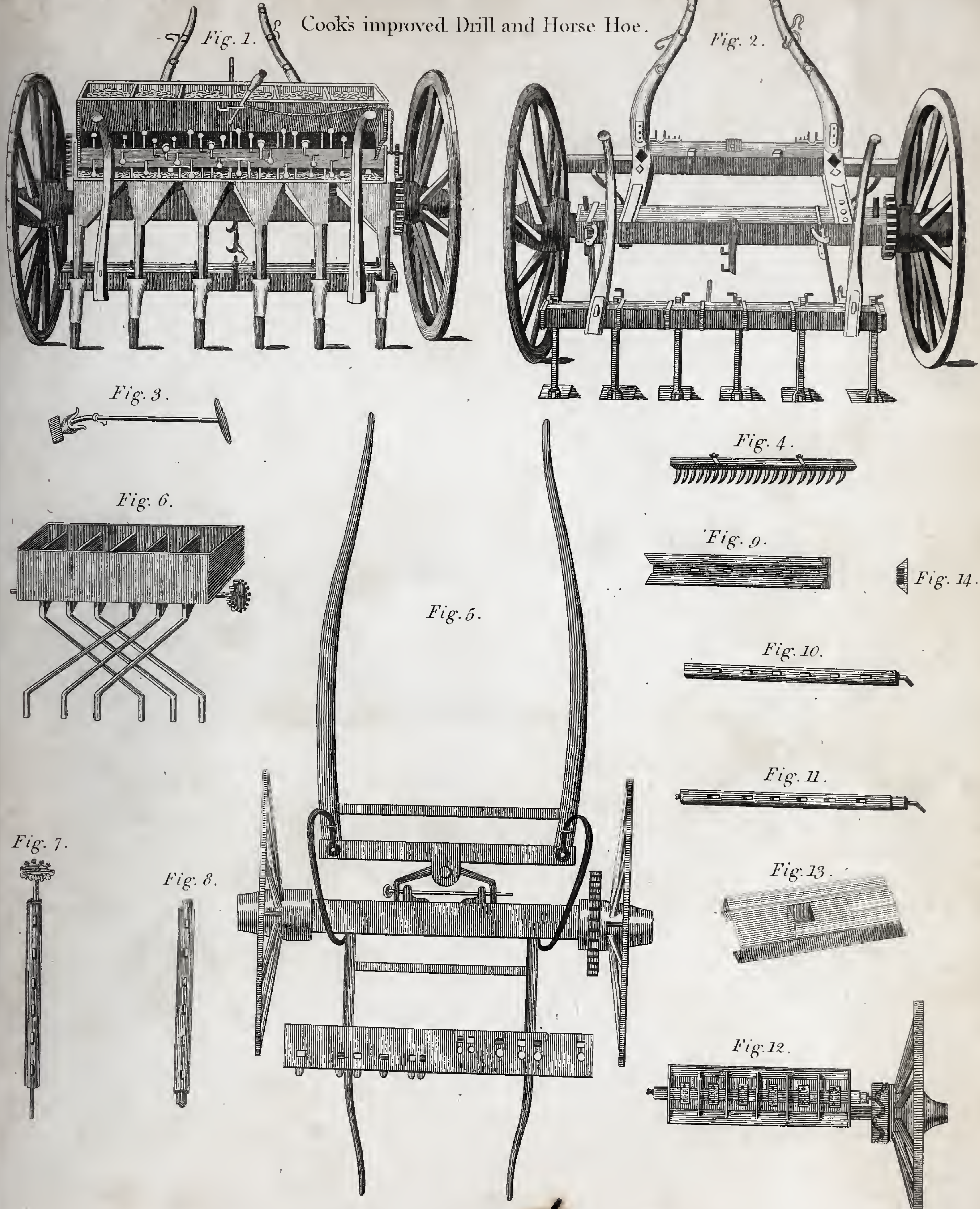
DRAINING PLOUGHS.



Barlow sculp

Cook's improved Drill and Horse Hoe.



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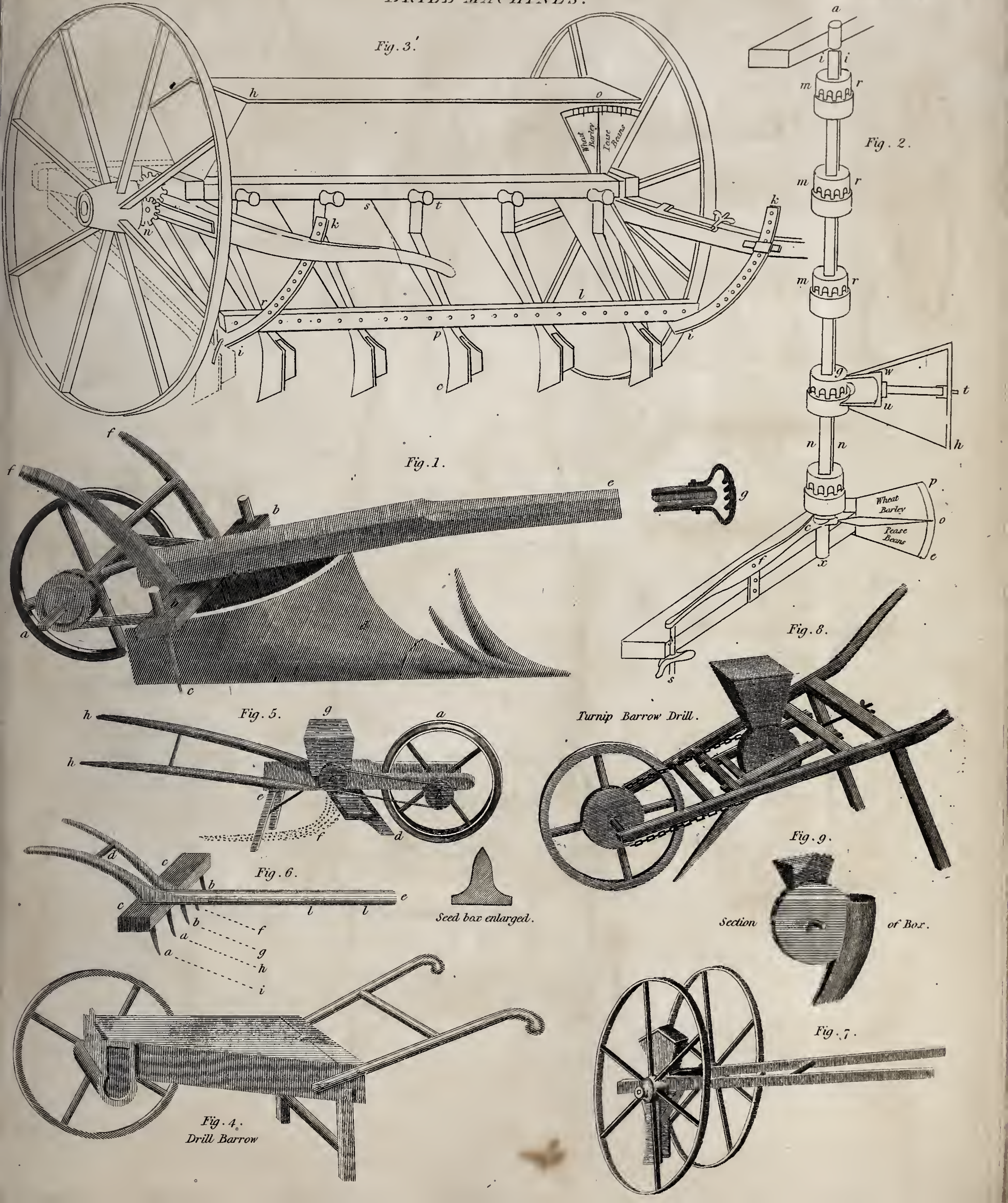
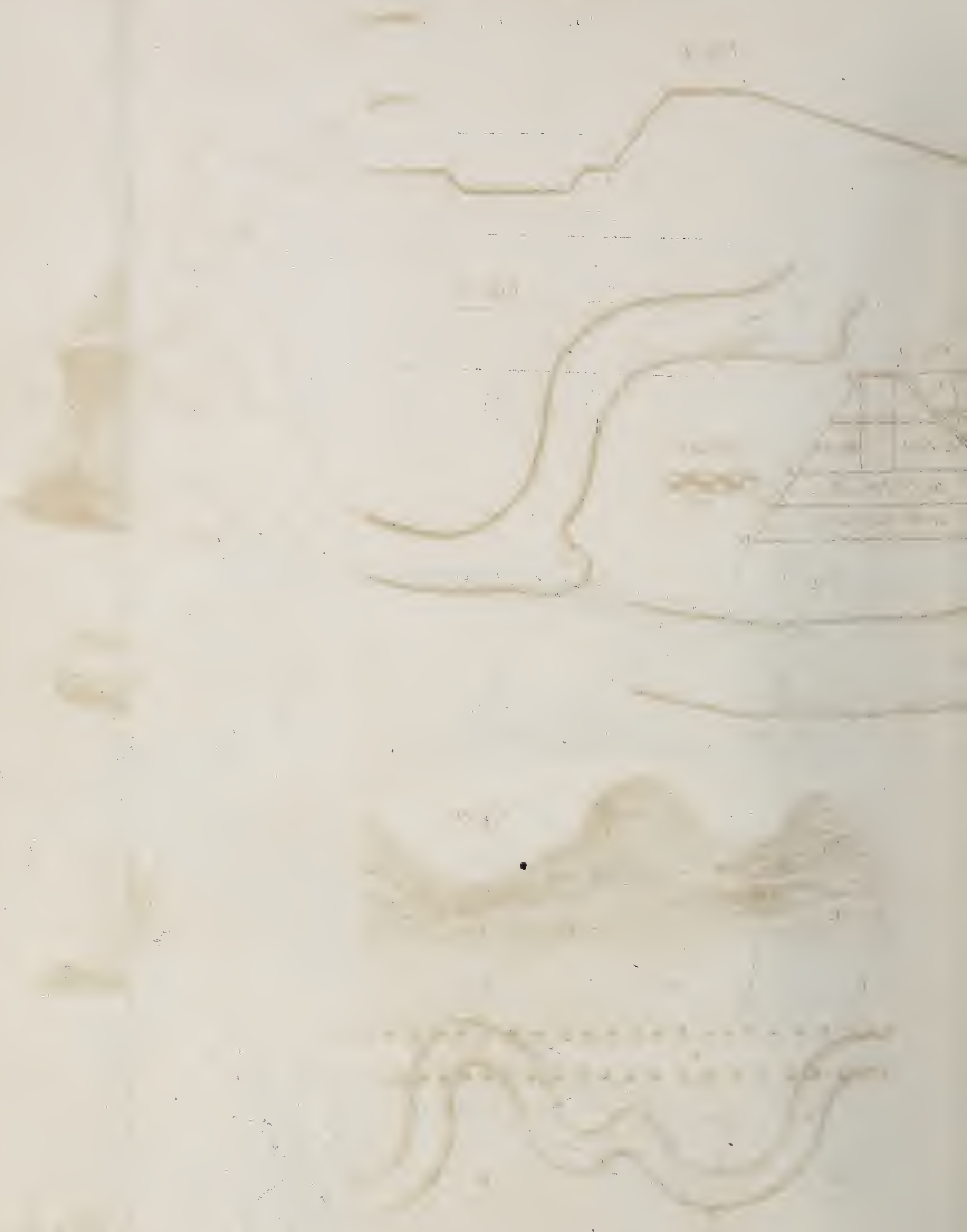
Barlow sculp.

DRILL MACHINES.





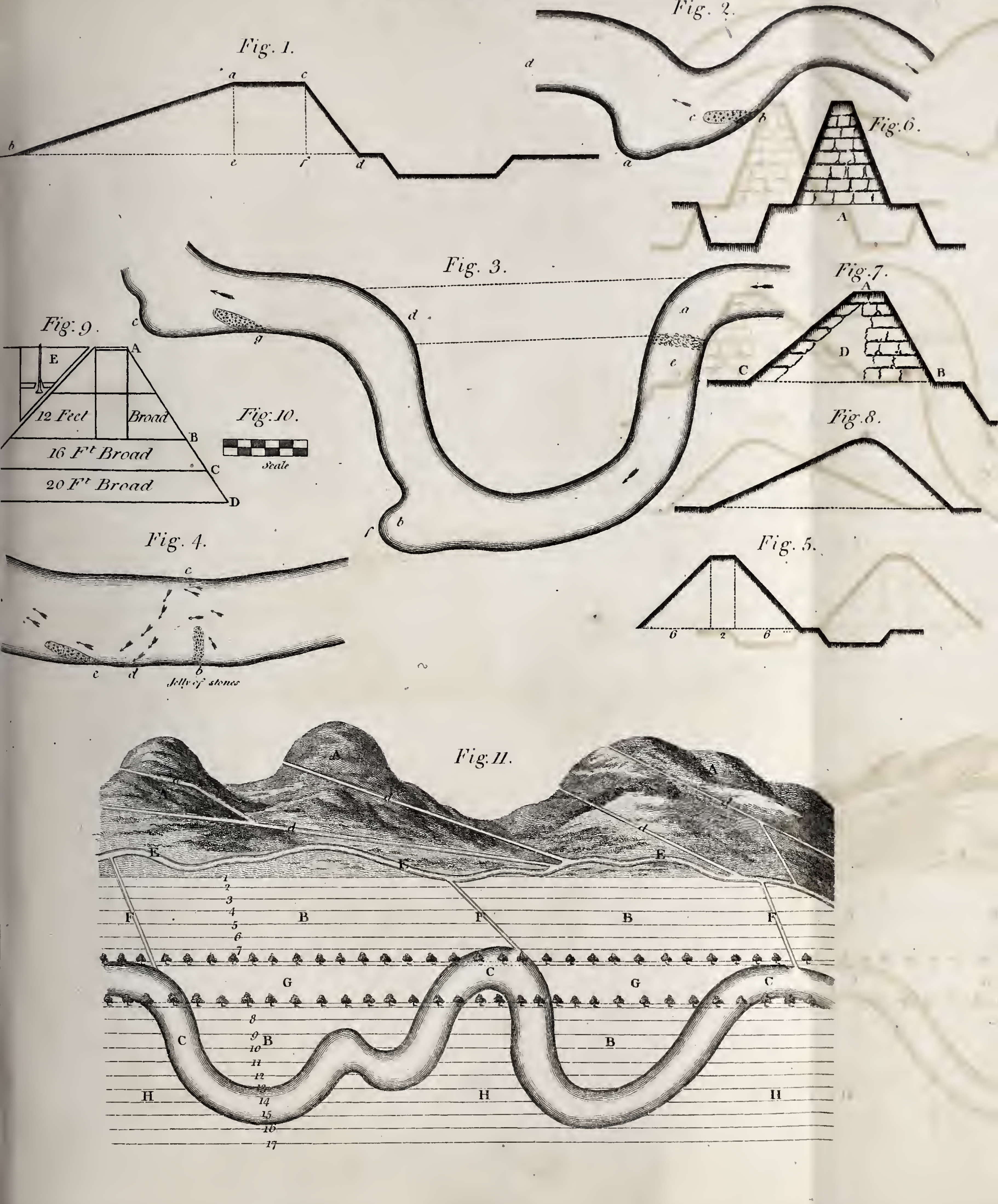


Fig. 1.
a
c
b
e
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Fig. 2.
d
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Fig. 6.
A
Fig. 3.
d
a
c
g
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f
b
Fig. 7.
A
D
C
B
Fig: 9.
E
A
12 Feet
Broad
B
16 F^t Broad
C
20 F^t Broad
D
Fig: 10.
Scale
Fig. 8.
Fig. 4.
c
e
d
b
Jelly of stones
Fig. 5.
6
2
6
Fig. 11.
A
d
E
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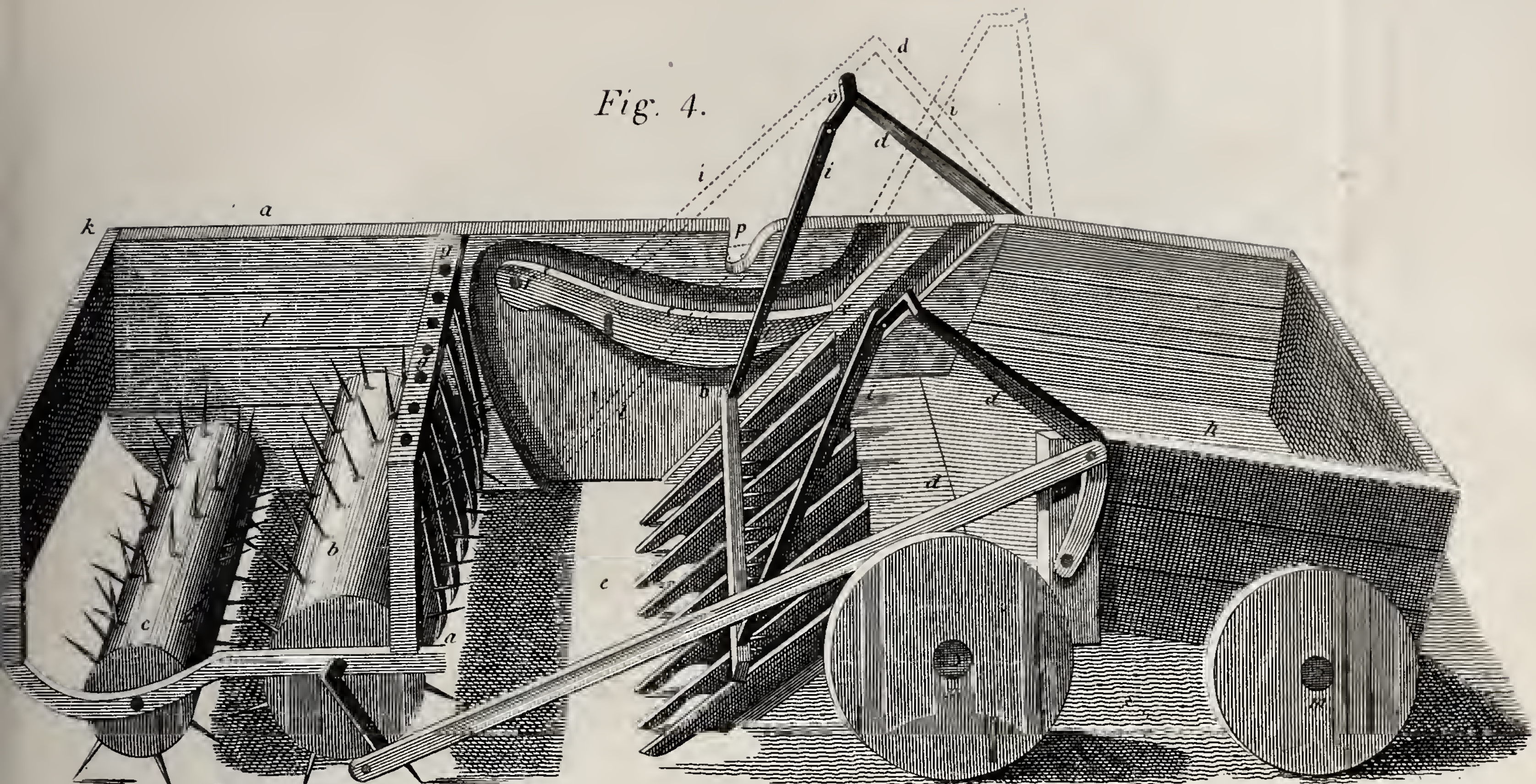
FALLOWING.

Fig. 4.



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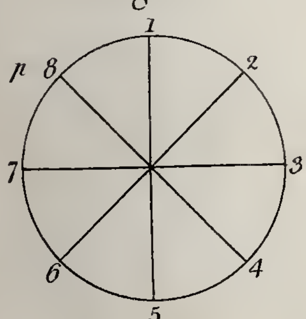


Fig. 5.

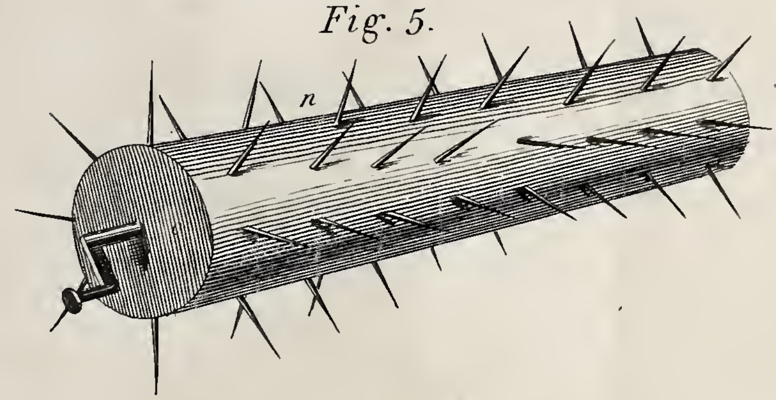
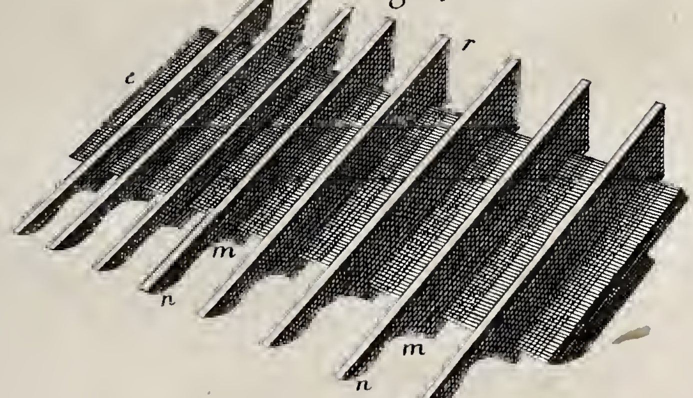


Fig. 9.

Fig. 7.



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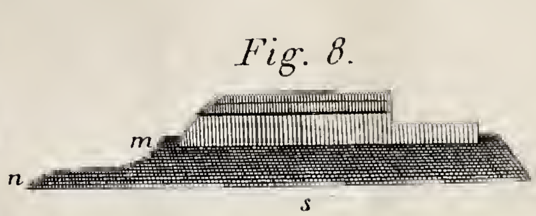

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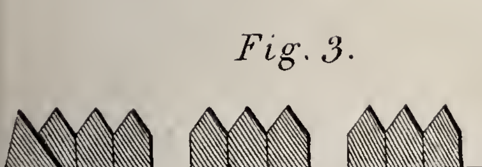


Fig. 2.

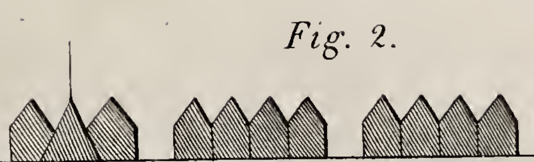
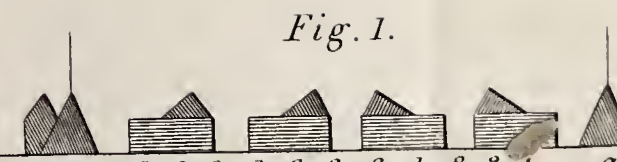


Fig. 1.



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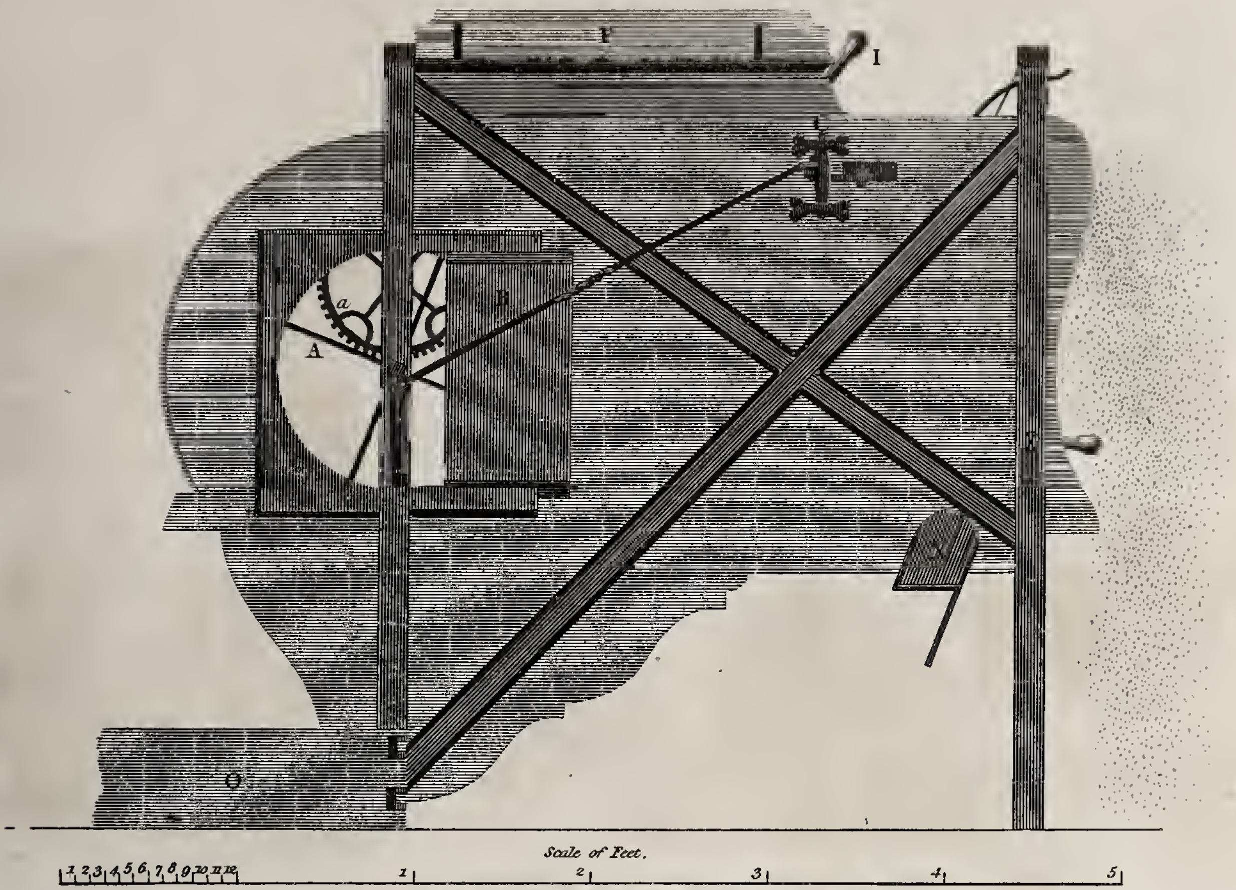
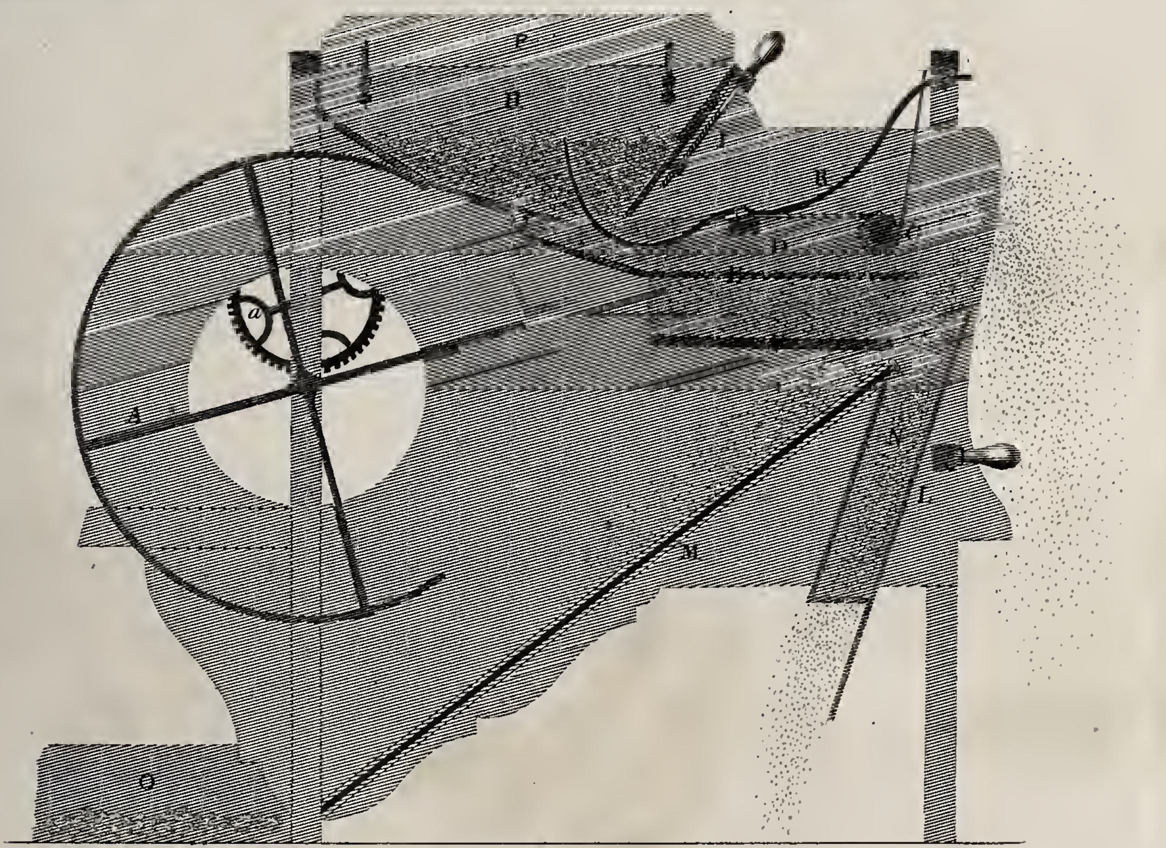
Mc. DOUGALE's FAN MACHINE.



Scale of Feet.



A *The fan turned by the cog wheel a*

B *Nostril slide to regulate the wind*

C *A bent lever communicating motion from a crank on the fan's spindle to the riddle frame* D *which it moves backward & forwards*

E F *The riddles*

G *A roller by which the riddle frame is raised or lowered*

H *The Hopper*

I *A Screw which regulates the feed*

K *An iron prong moved by the riddle frame to prevent straws &c stopping the mouth of the hopper*

L *The wind board*

M *The screen*

N *A spout which delivers the tail corn*

O *Foot boards for keeping the dressed corn together upon the floor*

P *A board on one side of the hopper to prevent the corn being spilt in filling. The corn runs down from the hopper* H *upon the riddles* E F *where the chaff & tail corn are blown away by the wind coming from the fan* A; *the chaff being the lightest is blown over the wind board* L *but the tail corn strikes against it and falls down the spout* N; *the heavy corn passes through both riddles & runs down the screen* M *to the floor at* O.

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FARM HOUSES.

Fig. 1.

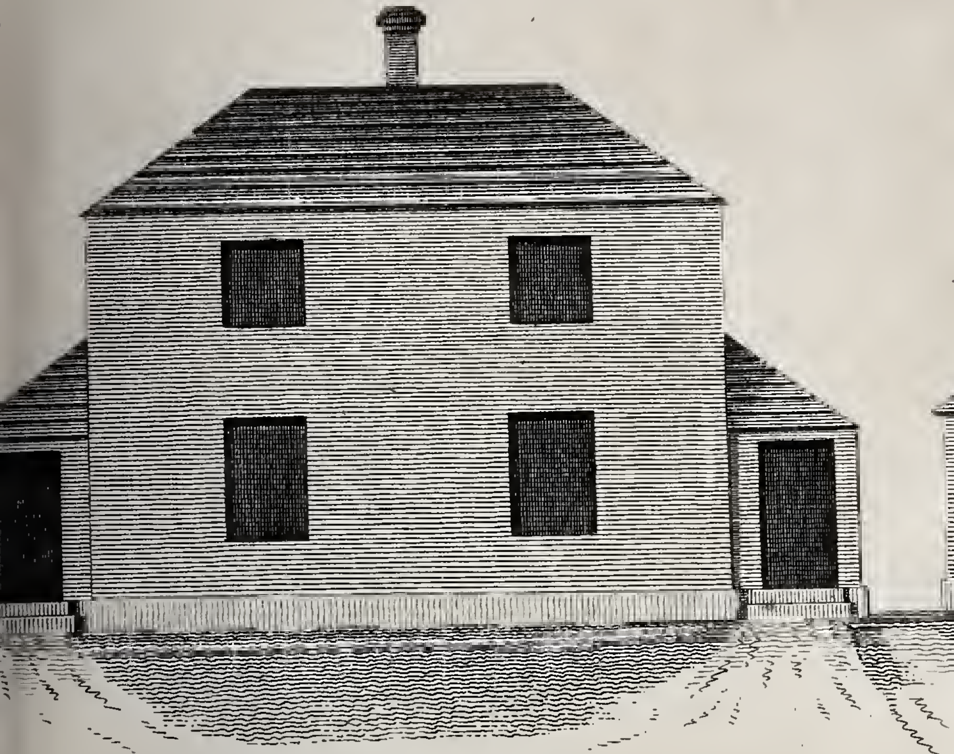


Fig. 2.

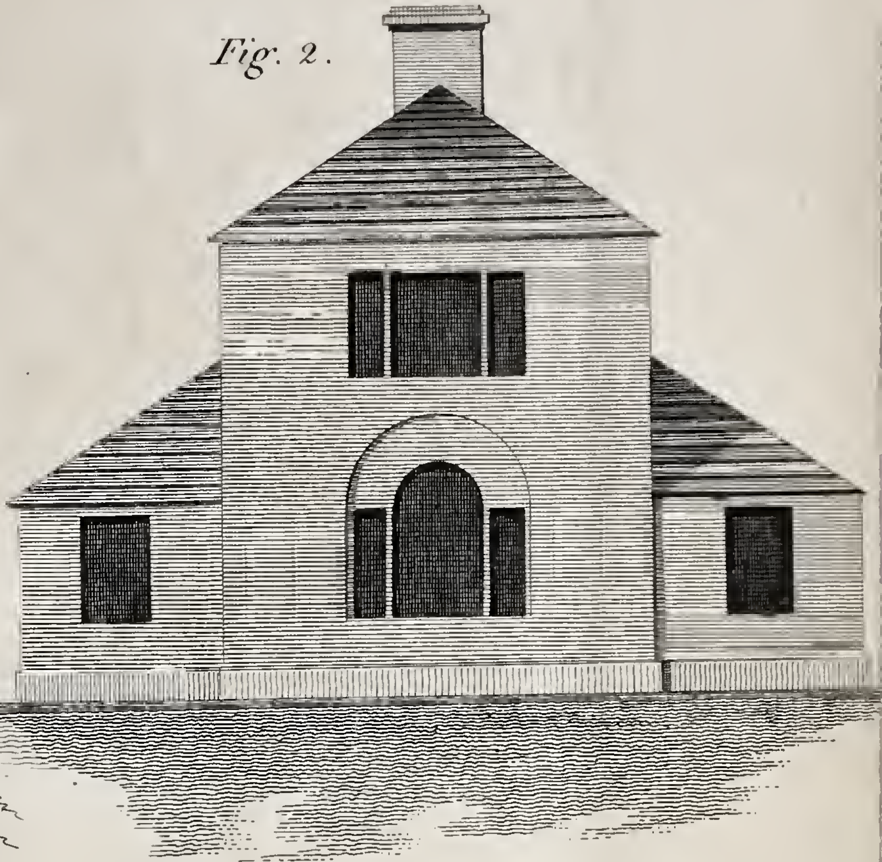
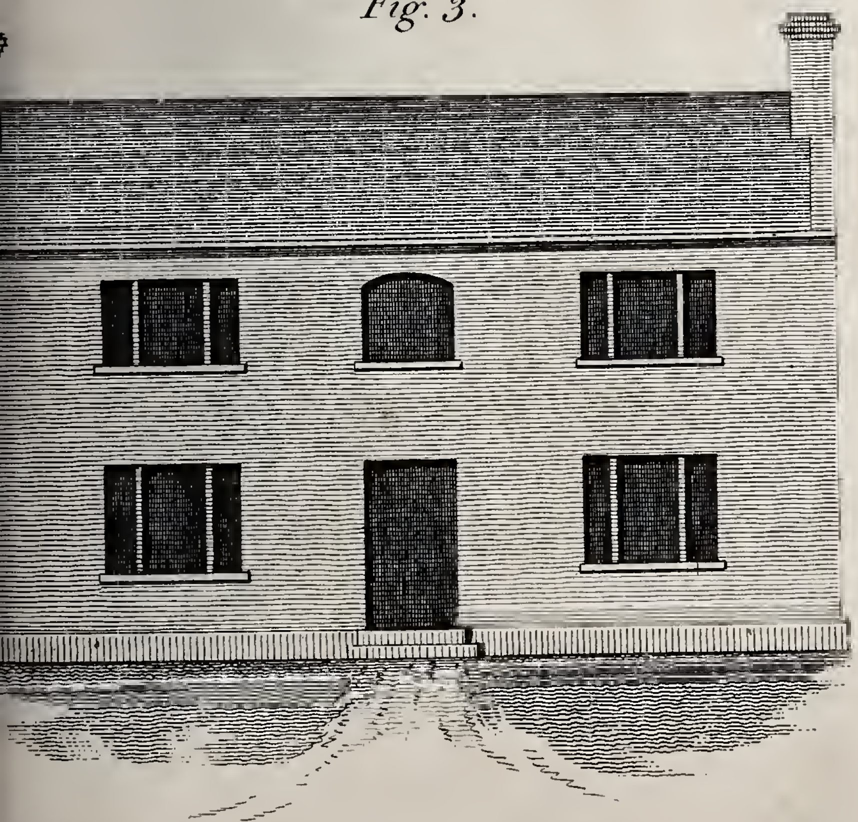


Fig. 3.



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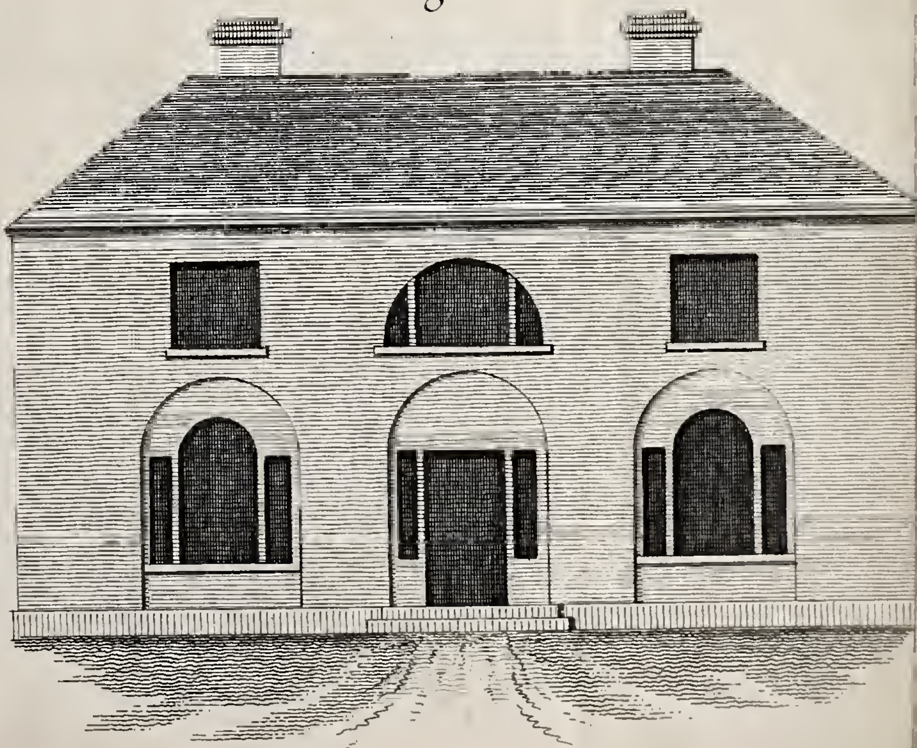


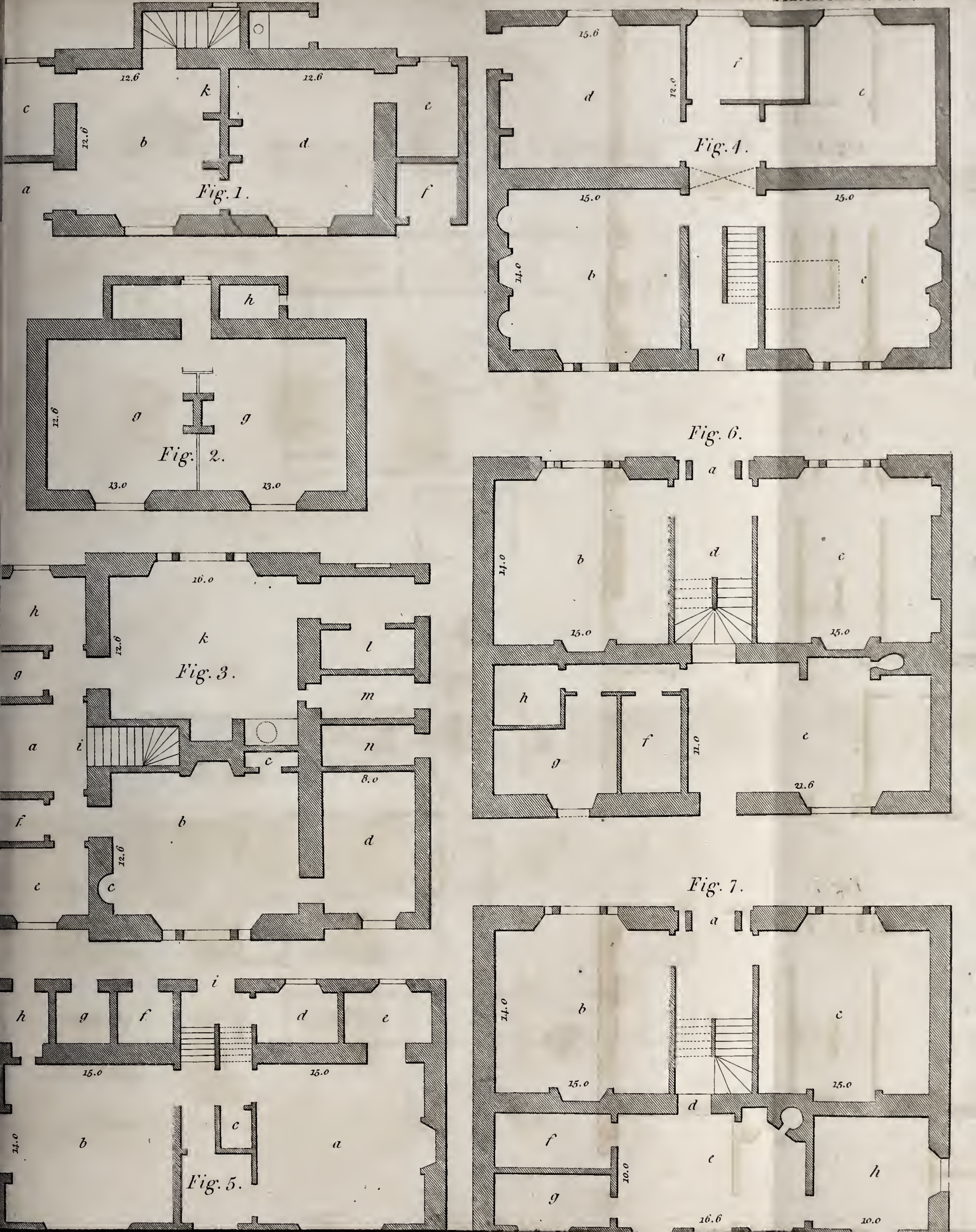


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.

FARM HOUSES, OFFICES & YARDS.

Fig. 1.

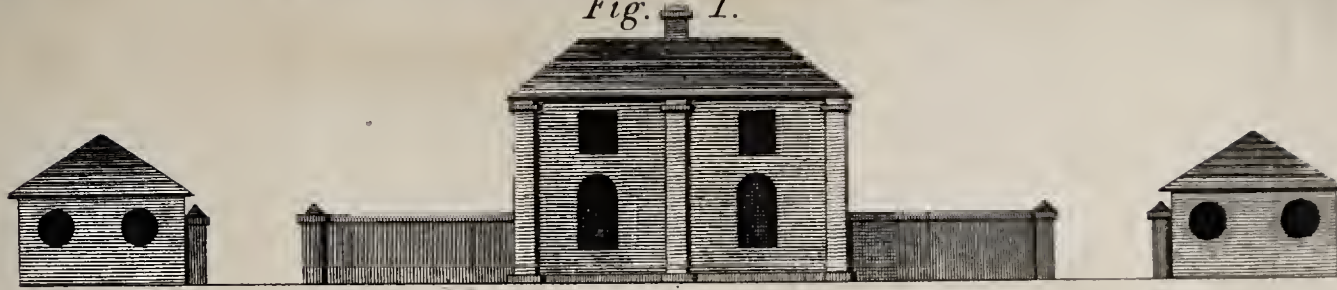
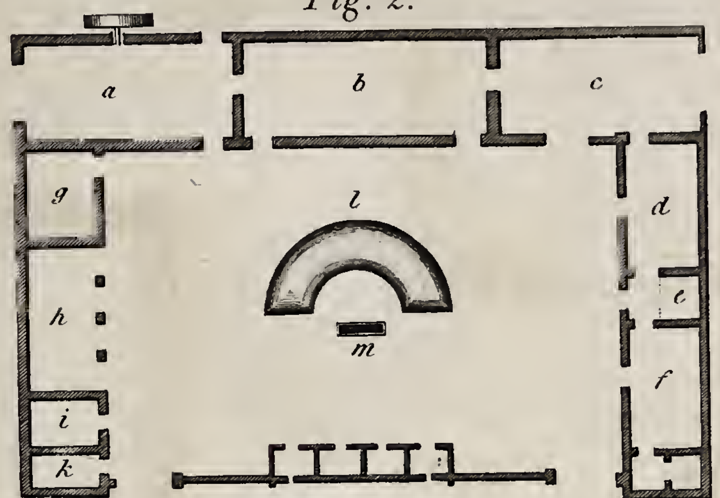


Fig. 2.



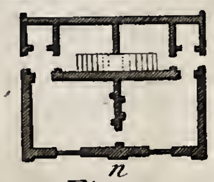
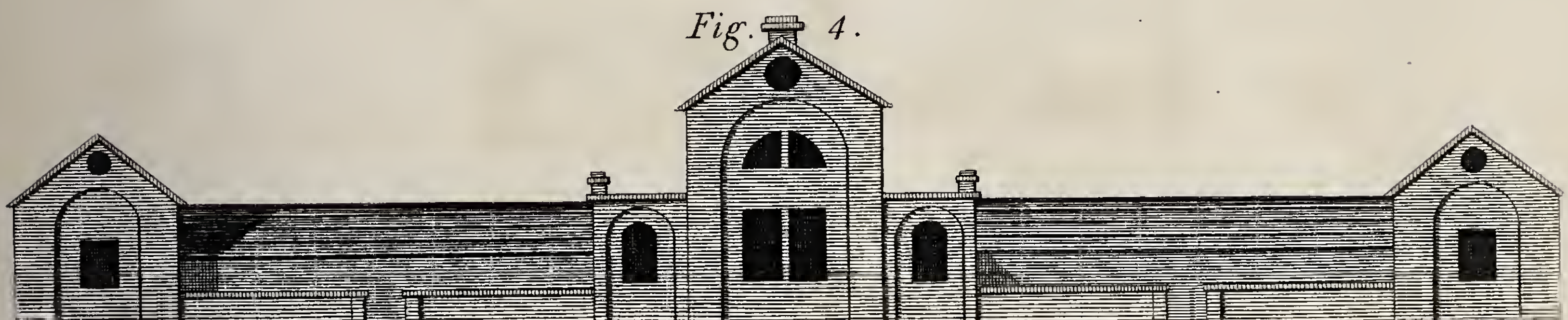


Fig. 3.

Fig. 4.



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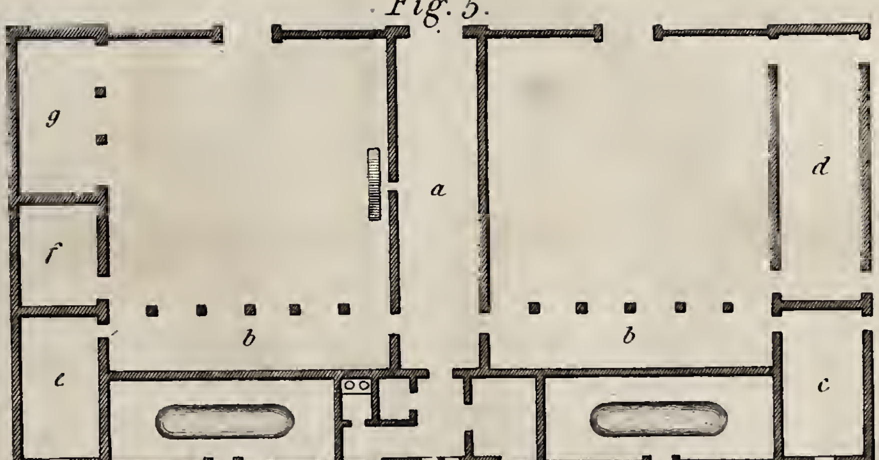

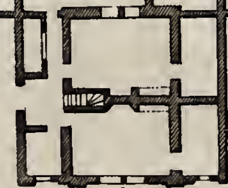

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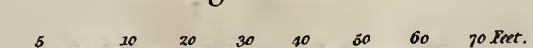

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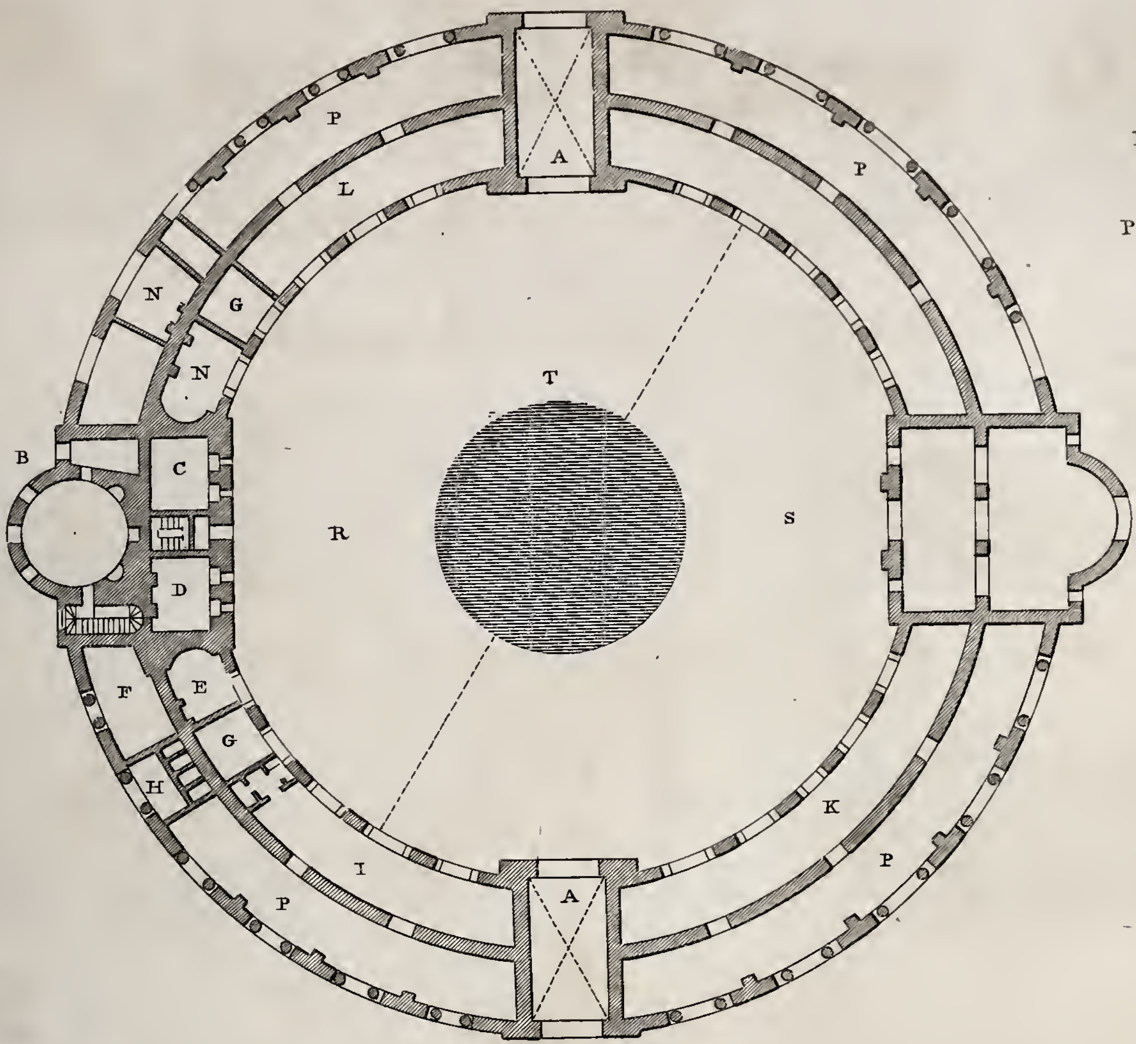
IMPROVED FARM YARDS.

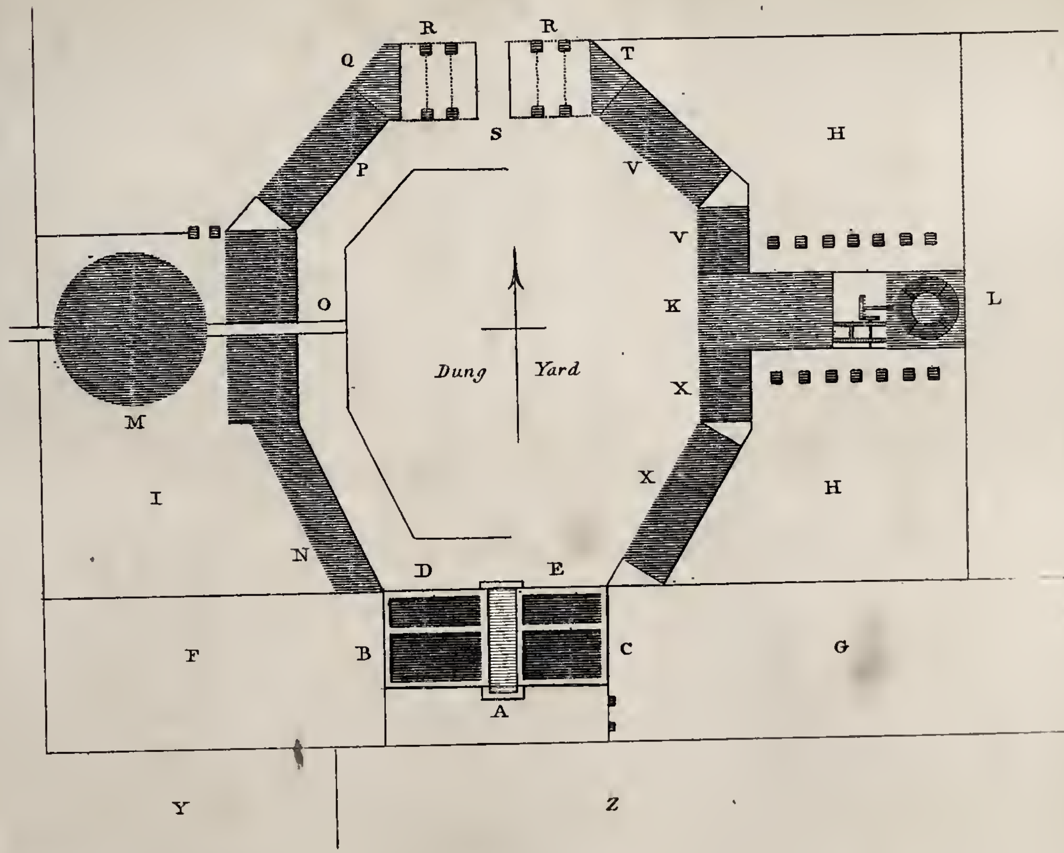
Fig. 1.



A Entrances
B Dwelling
C Dairy
D Kitchen
E Sculler
F Hen house
G Lobbies
H Breed^g House
I Calf houses

K Cow Byres
L Stables
NN Servants Apart^mts
O D^ble Barn
PPP Open Sheds
R Clean Yard
S Straw Yard
T Dung Pit

Fig. 2.



A Dwelling
B Kitchen
C Parlor
D Back Kitchen
E Dairy
F Poultry Yard
G Green
HH Straw Yard
I Hog Yard
K Straw Room
L Stack Yard
M Reservoir

N Hog Sties,
O Stables
P Work^g Oxen
Q Ploughs
RR Carriages & Granary over
S Entrance
T Tools
VV Cattle Sheds
XX Cow d^o.
Y Orchard
Z Garden
WW Watered Mowing Grounds

FENCES.

Fig. 1.

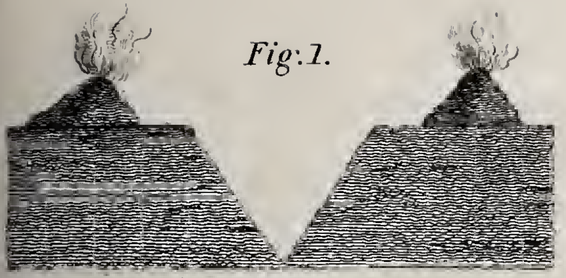
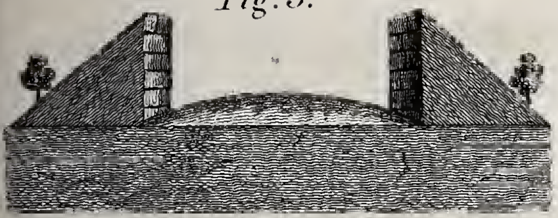


Fig. 2.

Fig. 3.



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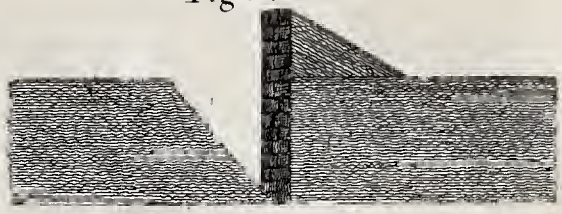


Fig. 5.

Fig. 6.

Fig. 7.

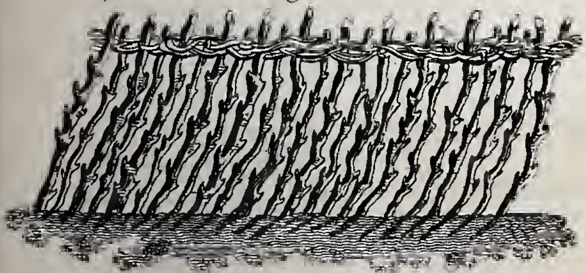


Fig. 8.

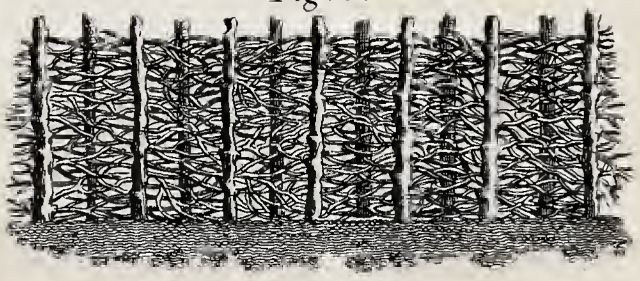
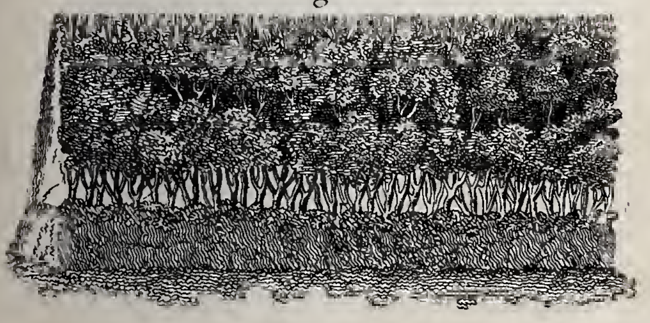


Fig. 9.



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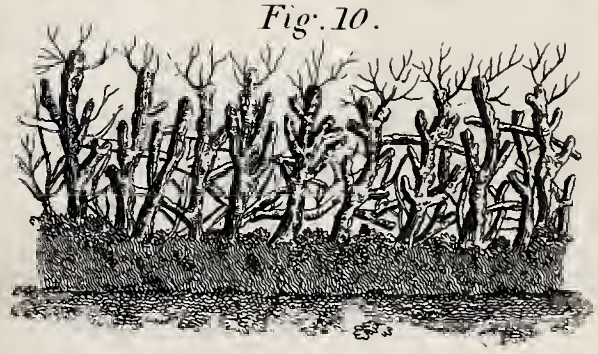


Fig. 11.

Fig. 12.

FENCES.

Fig. 1.

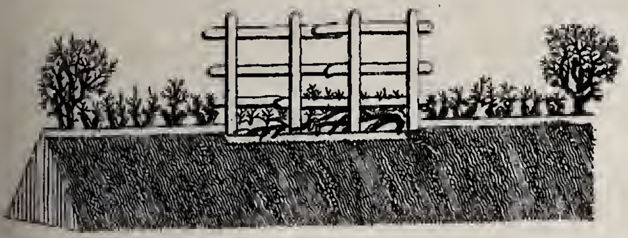


Fig. 2.

Fig. 3.

Fig. 4.

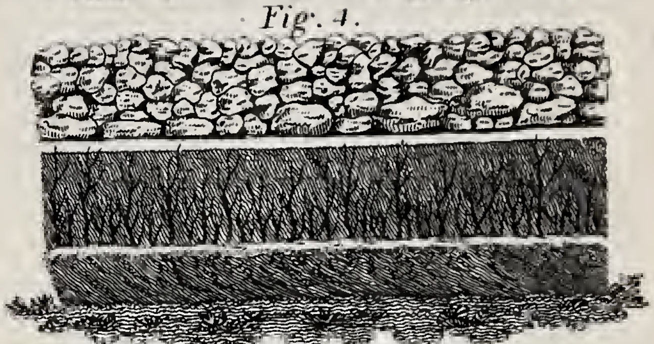
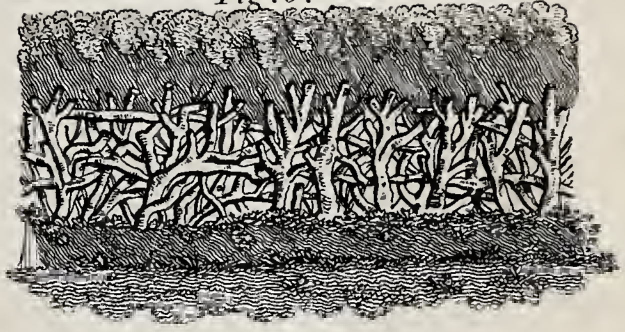


Fig. 5.

Fig. 6.



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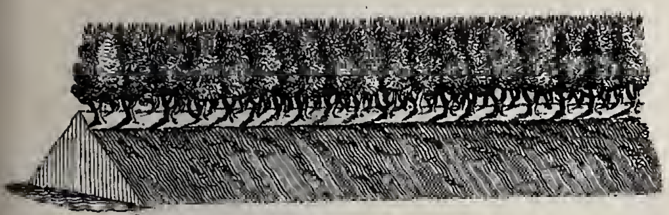


Fig. 8.

Fig. 9.

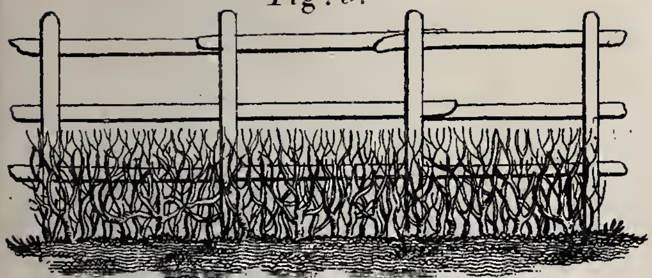


Fig. 10.

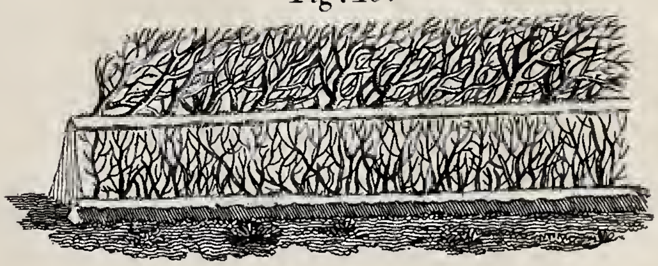


Fig. 11.

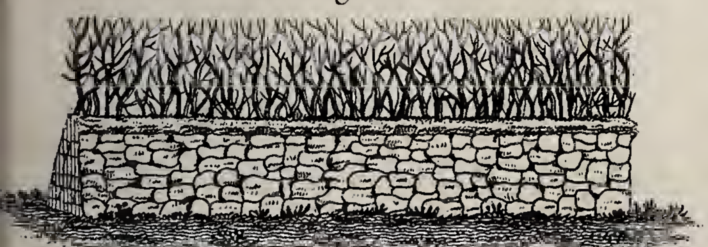
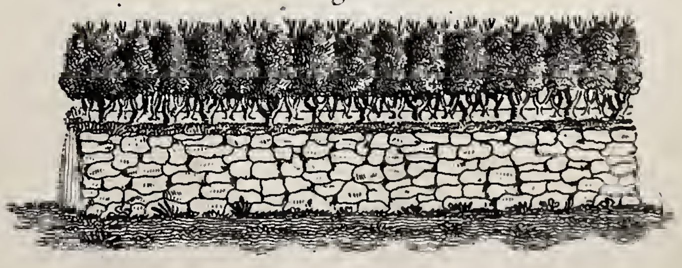


Fig. 12.



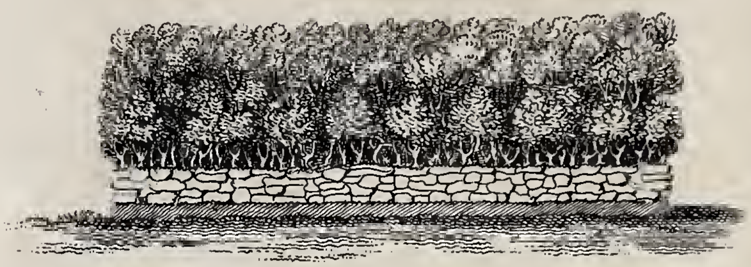
FENCES.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.



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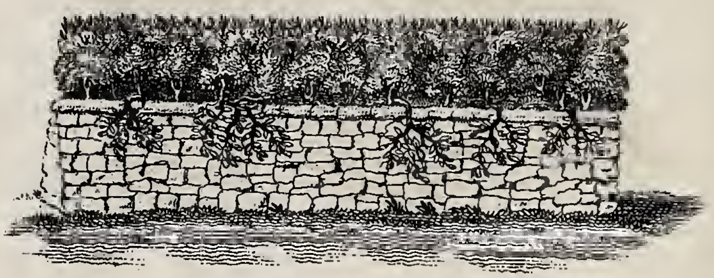

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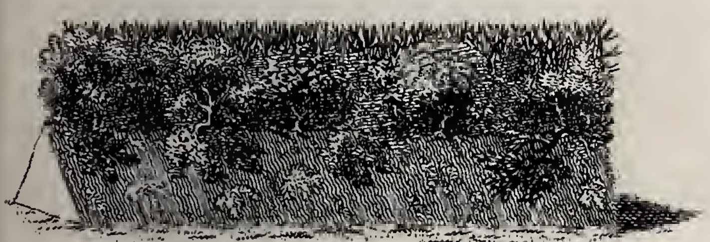

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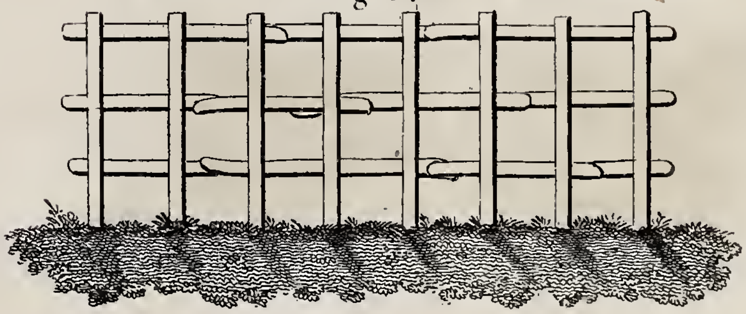

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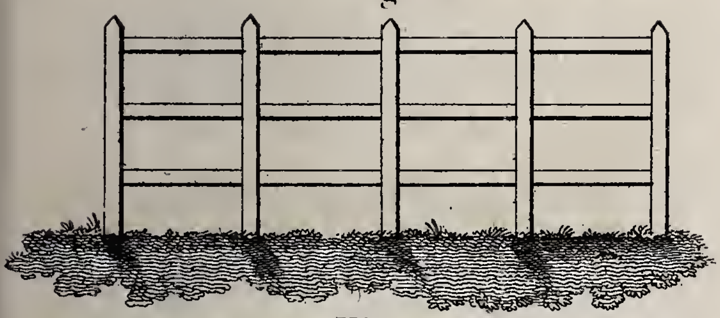

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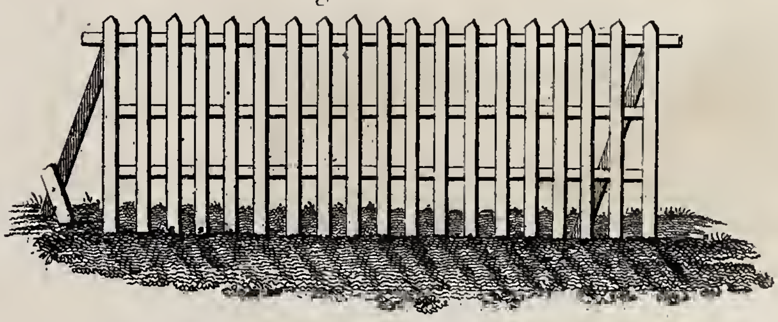

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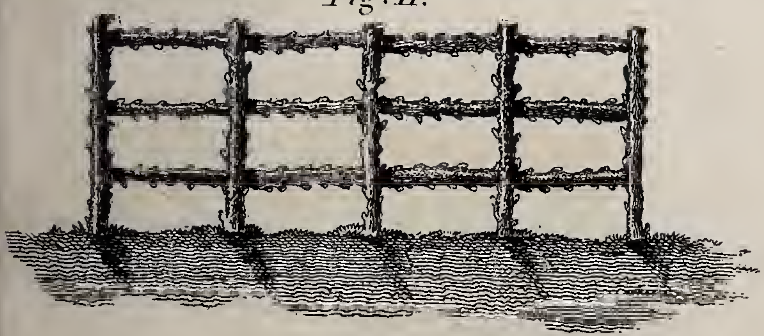

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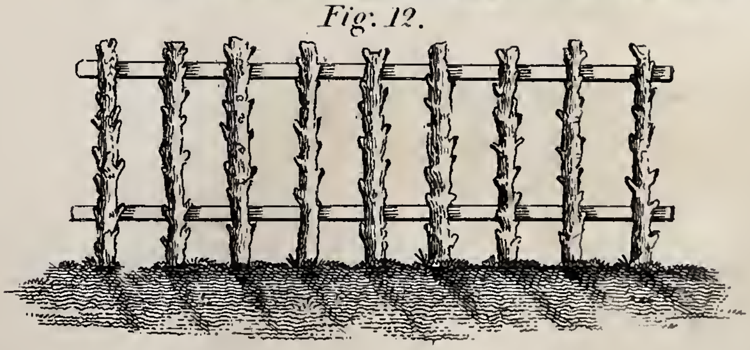

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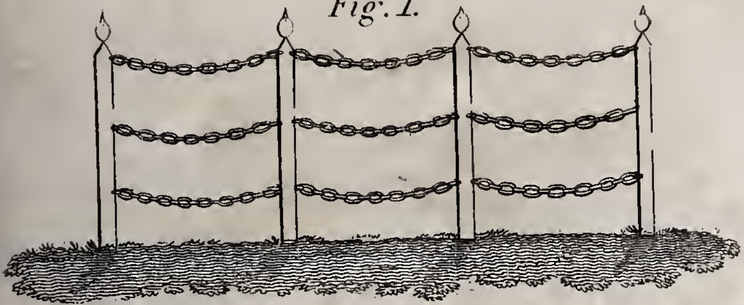

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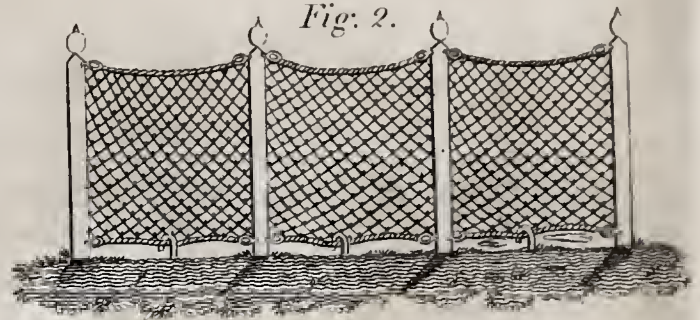

Fig. 3.

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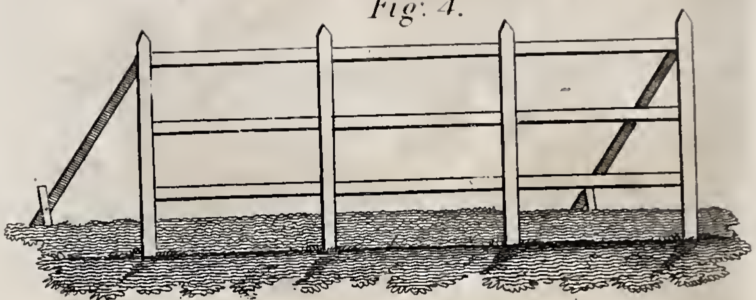

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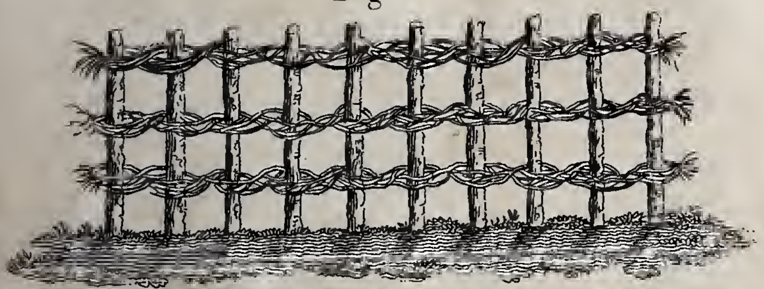

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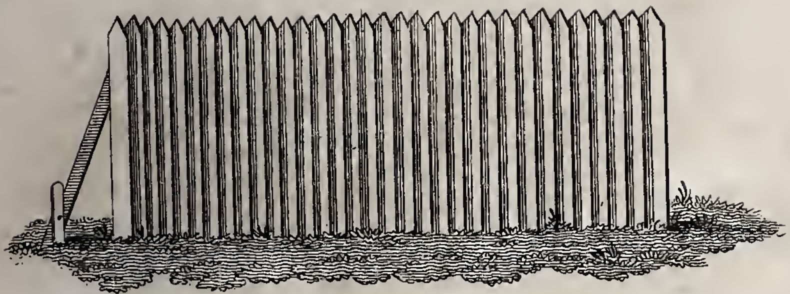
Fig. 7.



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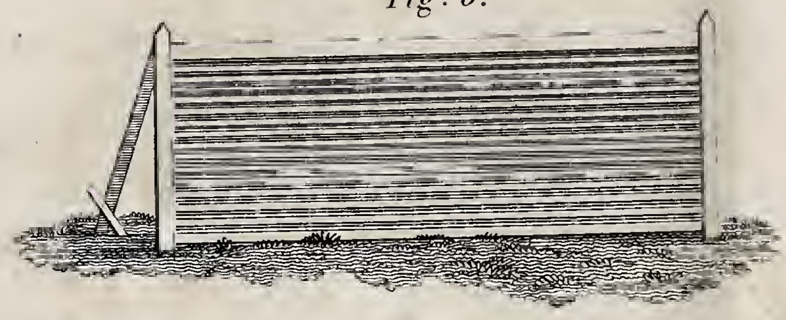

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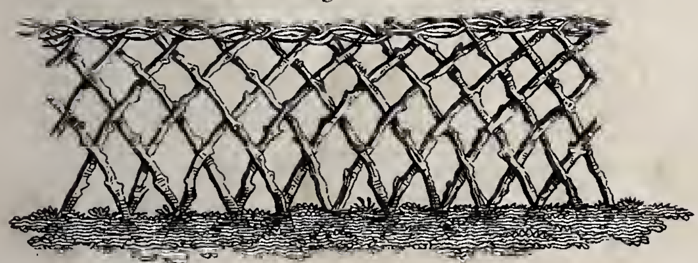

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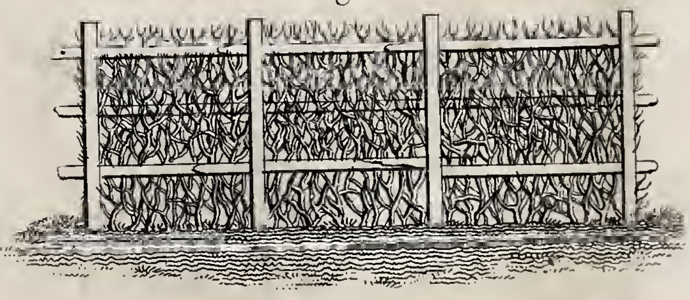

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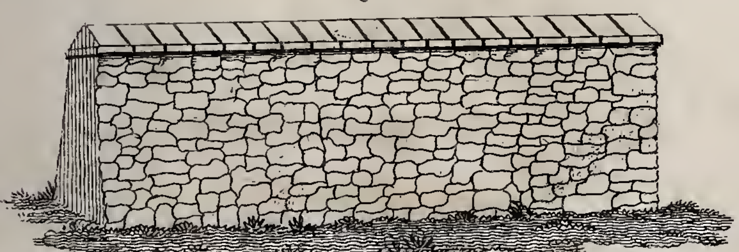

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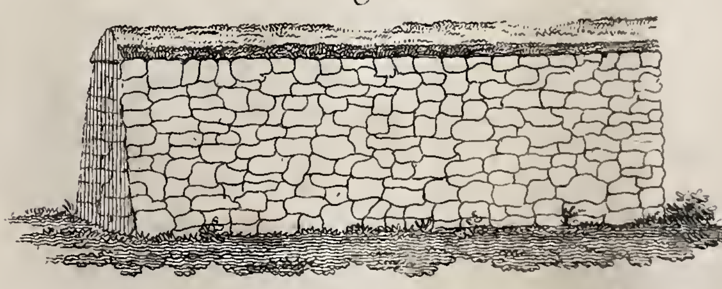
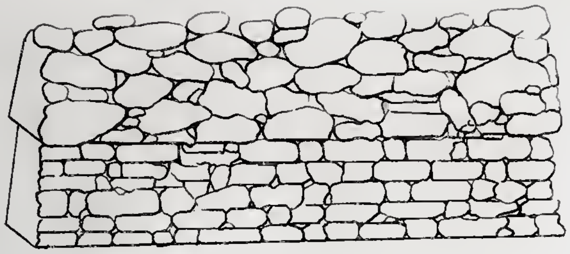


by Longman, Hurst, Rees, & Orme, Paternoster Row.

FENCES.

Fig. 1.



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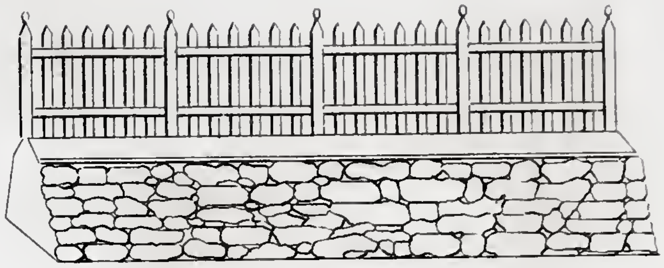

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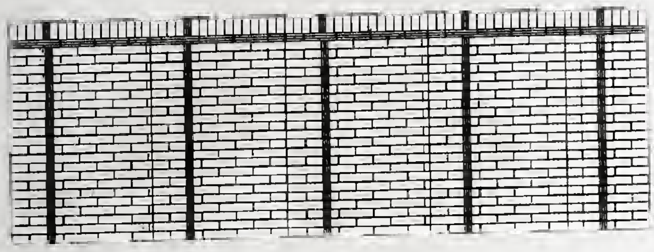

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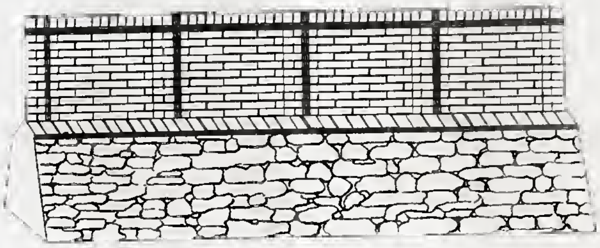

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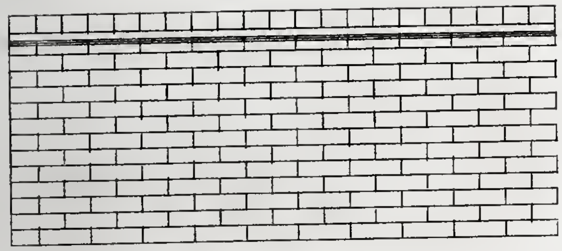

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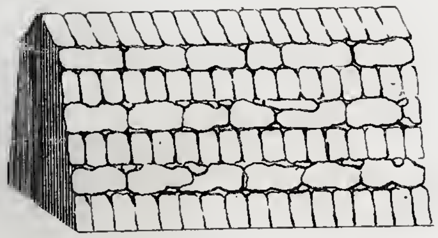

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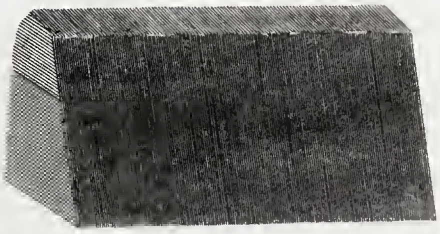

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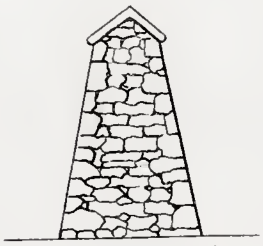

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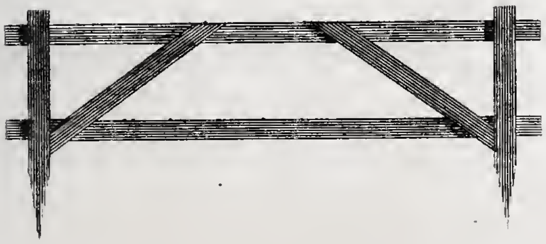

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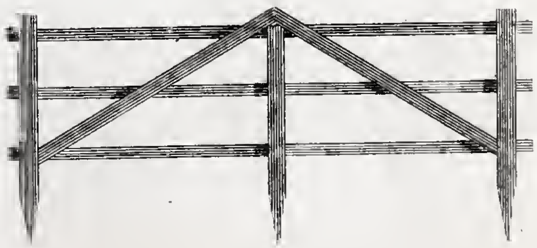
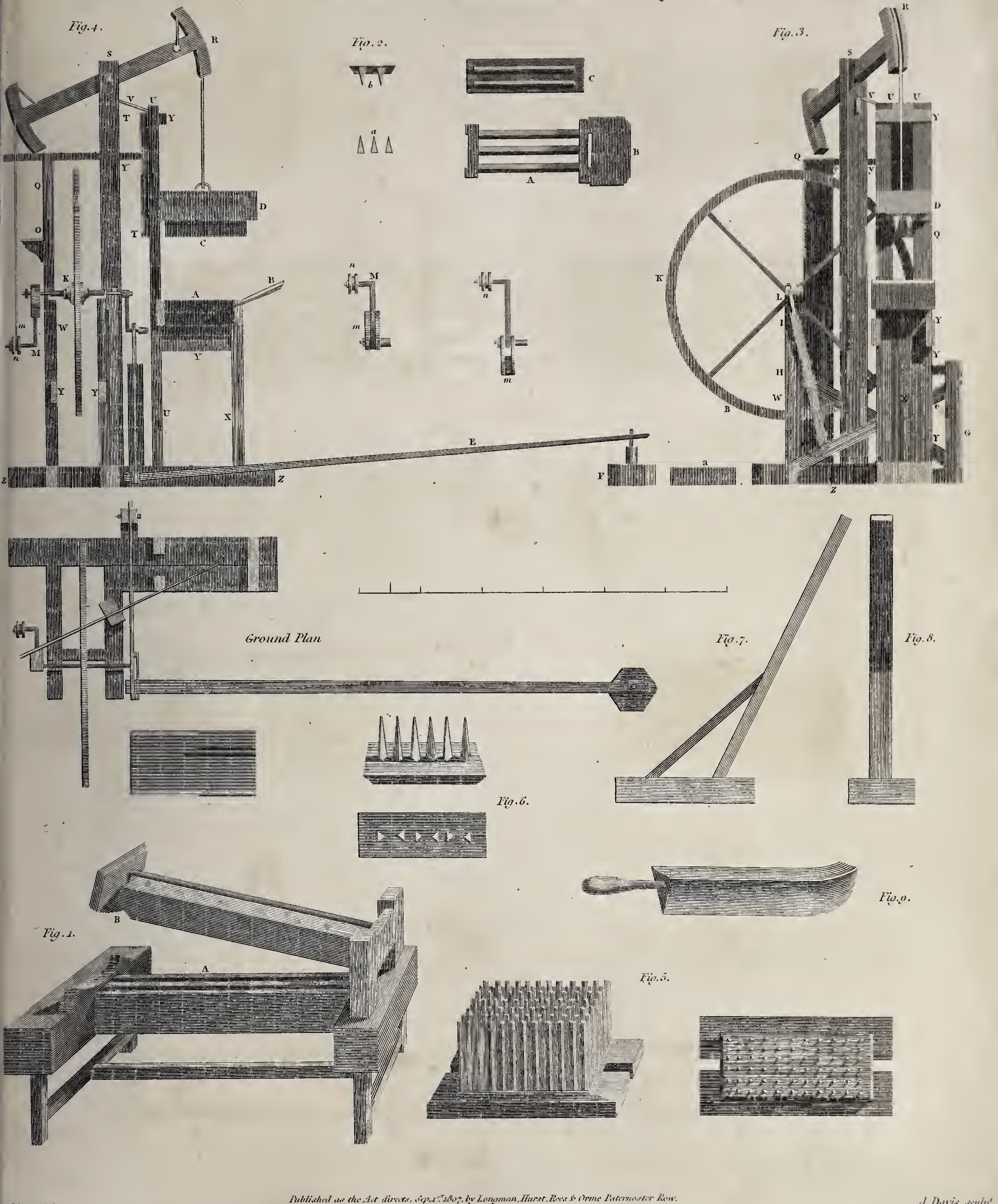


Blunt del. et sc.

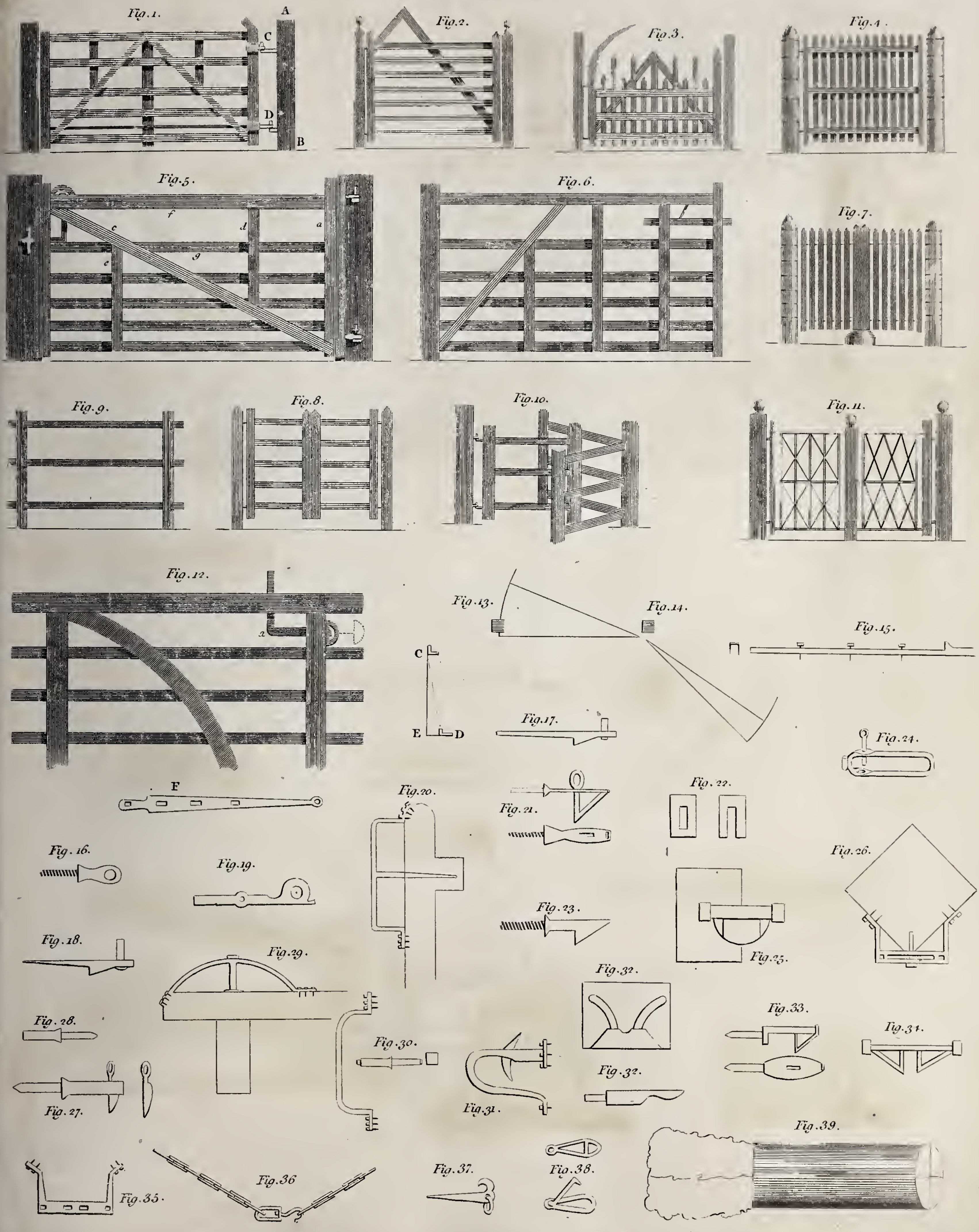
Published as the Act directs, June 1.1807, by Longman, Hurst, Rees, & Orme, Paternoster Row.

APPARATUS FOR DRESSING FLAX.



Blunt del. Published as the Act directs, Sep. 1st 1807, by Longman, Hurst, Rees & Orme Paternoster Row. J. Davis sculpt.

GATES AND FASTENINGS.

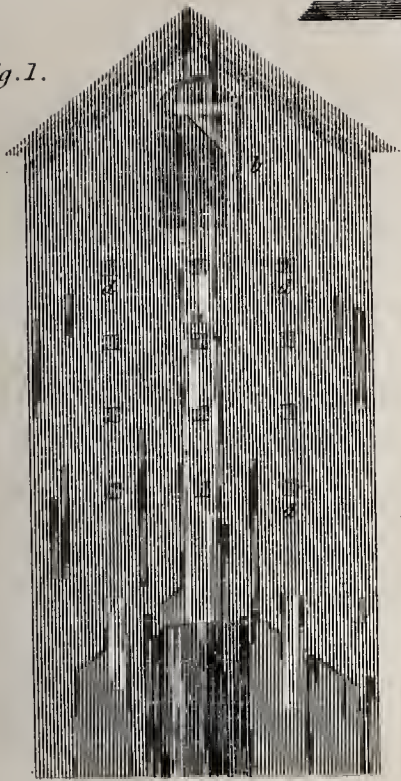


Published as the Act directs, Feb. 1. 1807, by Longman Hurst Rees & Orme Paternoster Row.

GRANARIES.

Fig. 3.

Fig. 1.



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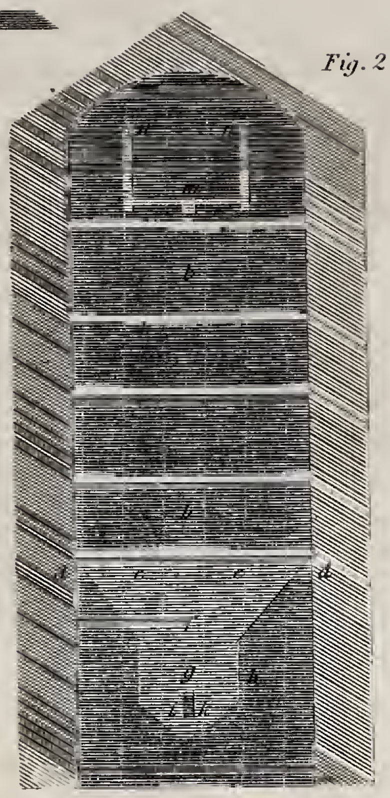

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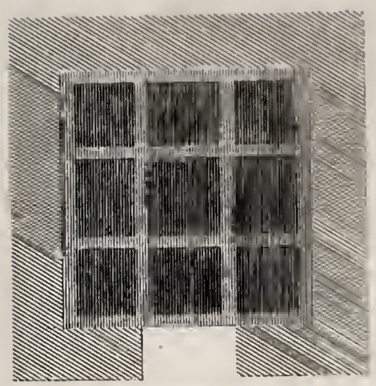

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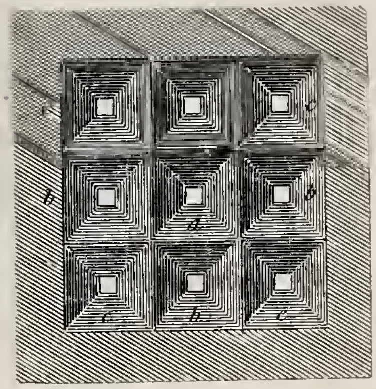

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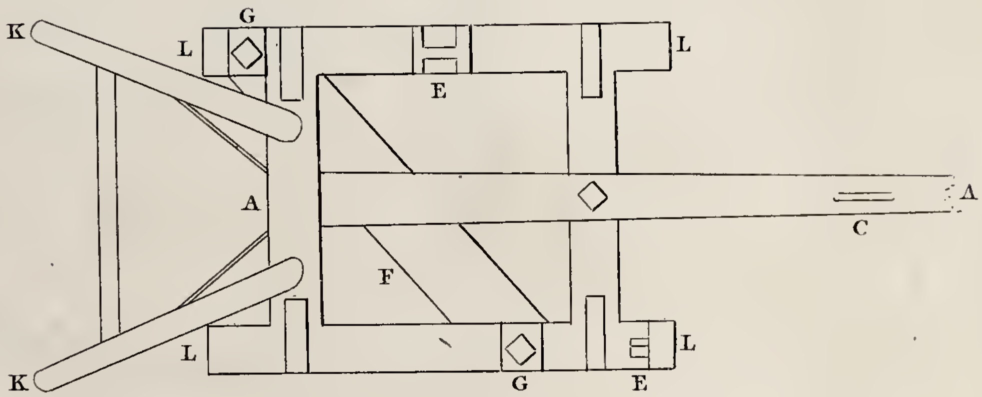

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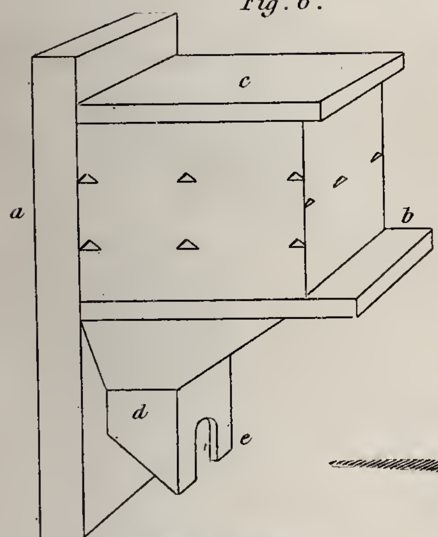

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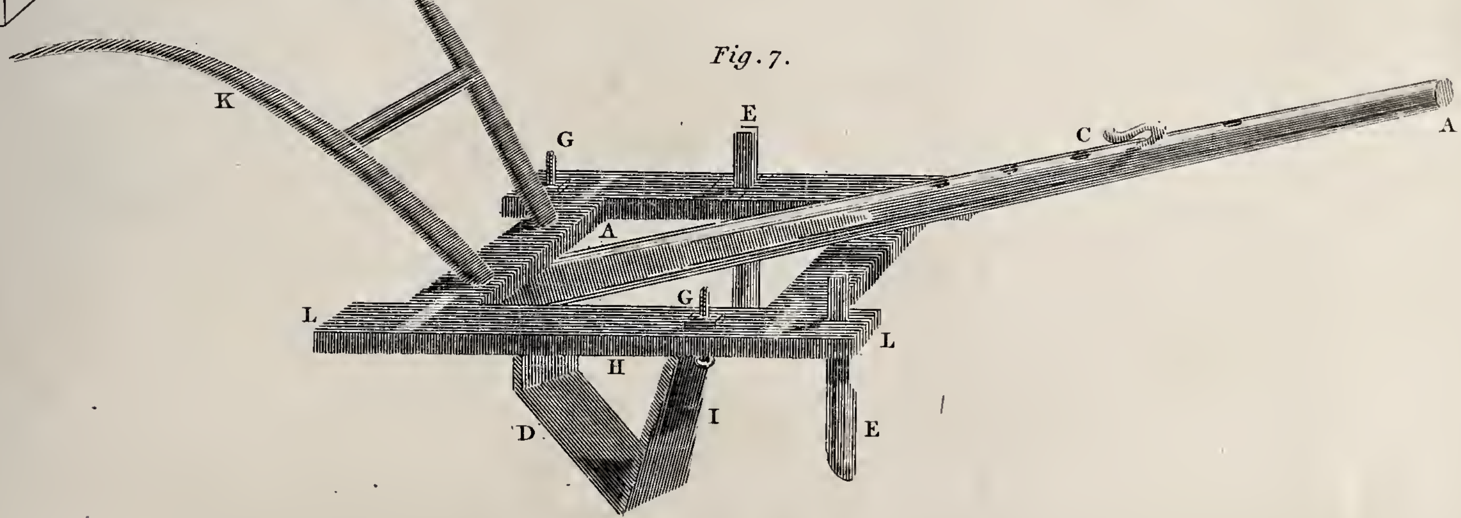

GRASSES.

Fig. 1. …thoxanthum Odoratum.

Fig. 2. Alopuarus Pratensis.

Fig. 3. Poa Pratensis.

Fig. 4. Poa Trivialis.

Fig. 5. Festuca Pratensis.

Fig. 6. Cynosurus Crist…

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GRASSES.

Fig. 1. Festuca Ovina.

Fig. 2. Festuca Duriuscula.

Fig. 3. Poa Compressa.

Fig. 4. Poa Palustris.

Fig. 5. Phleum Nodosum.

Fig. 6. Lolium Perenne.

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ARTIFICIAL GRASSES.

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Barlow Sculp

Fig. 1.

Red or Broad Clover.
Trifolium Pratense.

Fig. 2.

White or Dutch Clover.
Trifolium Repens.

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Barlow Sculp.

ARTIFICIAL GRASSES

Fig. 5.

Trefoil.
Medicago Luputina.

Fig. 6.

Rough Cocks-foot Grafs.
Dactylis Glomarata.

Barlow Sculp

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HAY-SWEEPS.

Fig. 1.

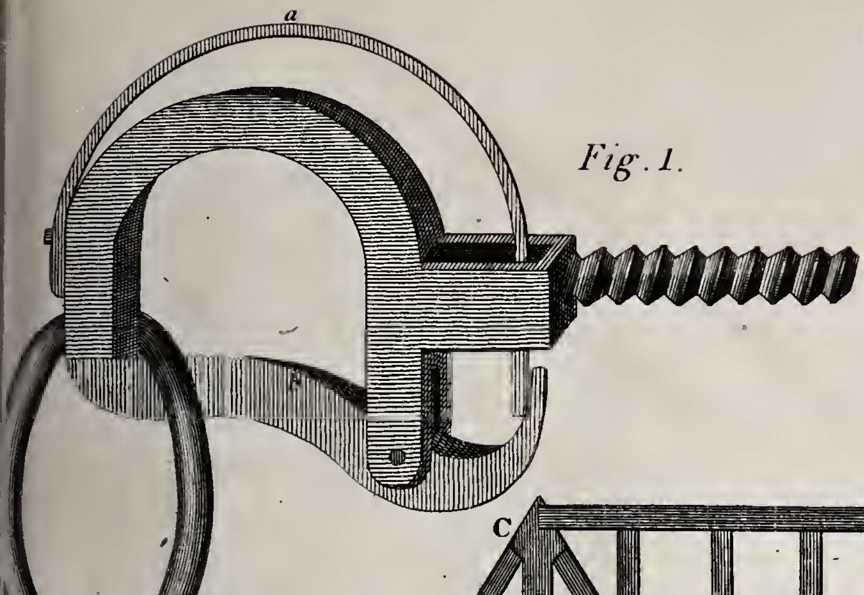
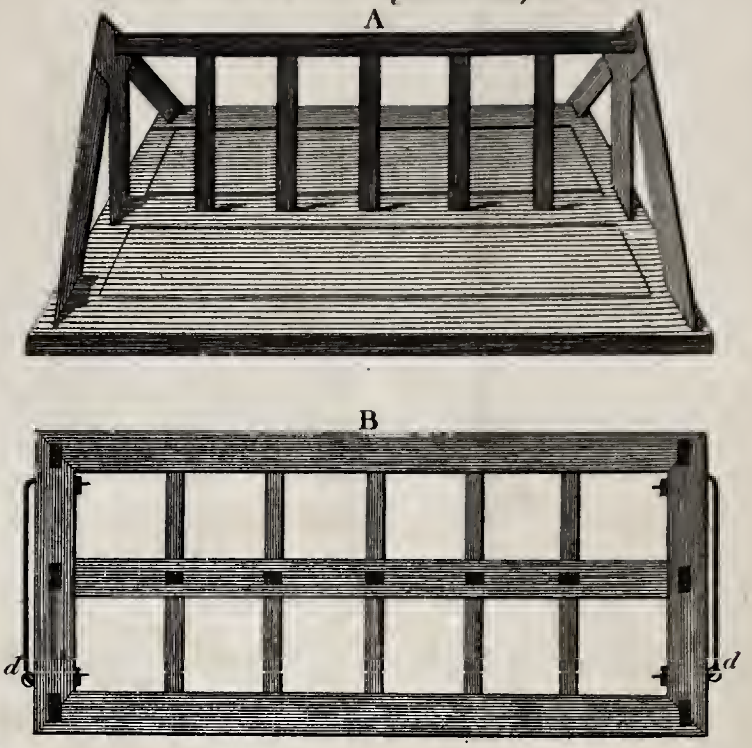
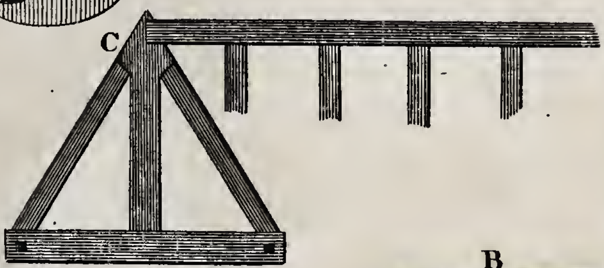
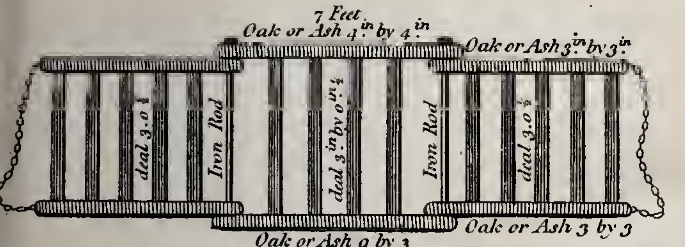


Fig. 2.

Yorkshire Hay Sweep.







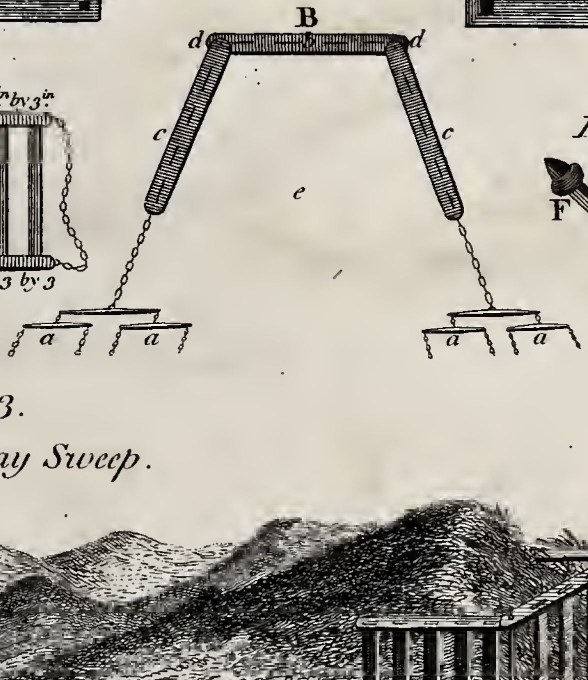
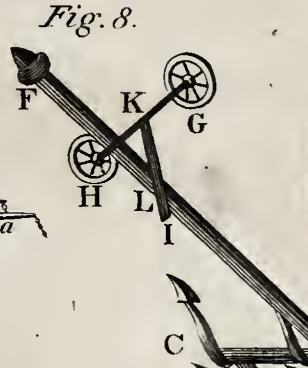


Fig. 3.

Middleton's Hay Sweep.

Fig. 8.



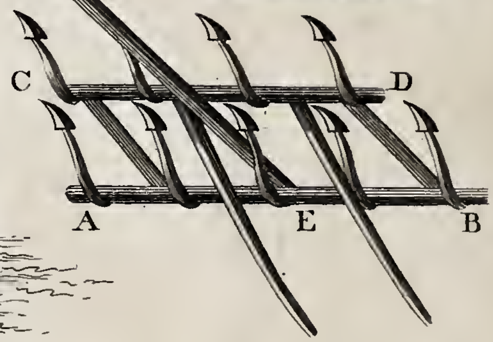


Fig. 9.

Churlock.

Fig. 4.

Corn Crowfoot.

Fig. 5.

Corn Marygold.

Fig. 6.

Small Corn Parsley.

Fig. 7.

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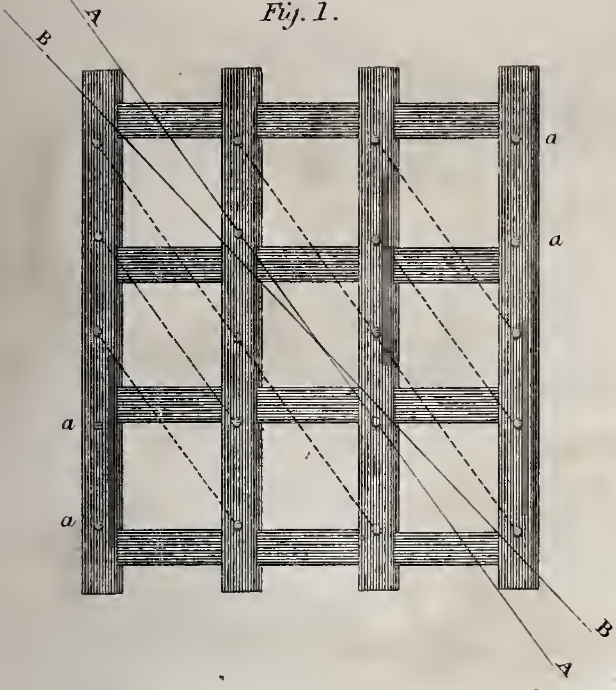
HARROWS.

Common Harrow.

Fig. 1.



Improved Harrow.

Fig. 2.

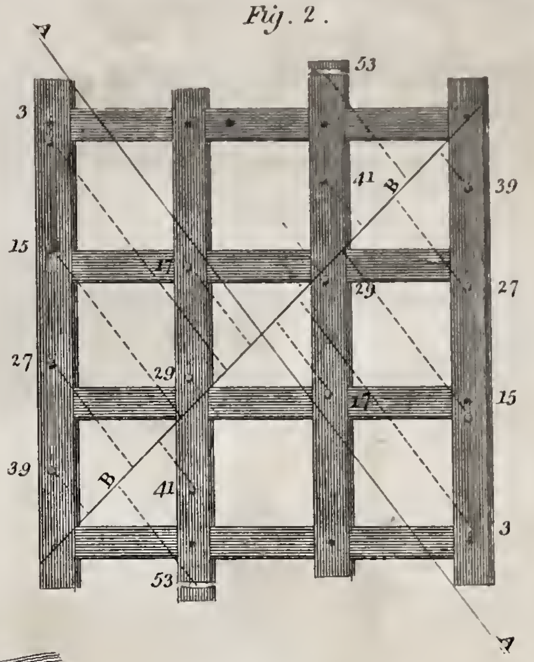


Fig. 5.

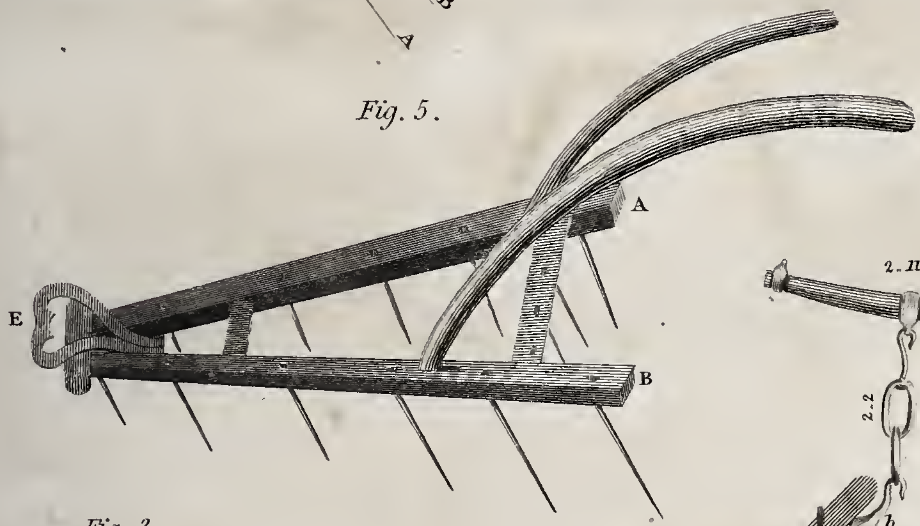


Fig. 4.

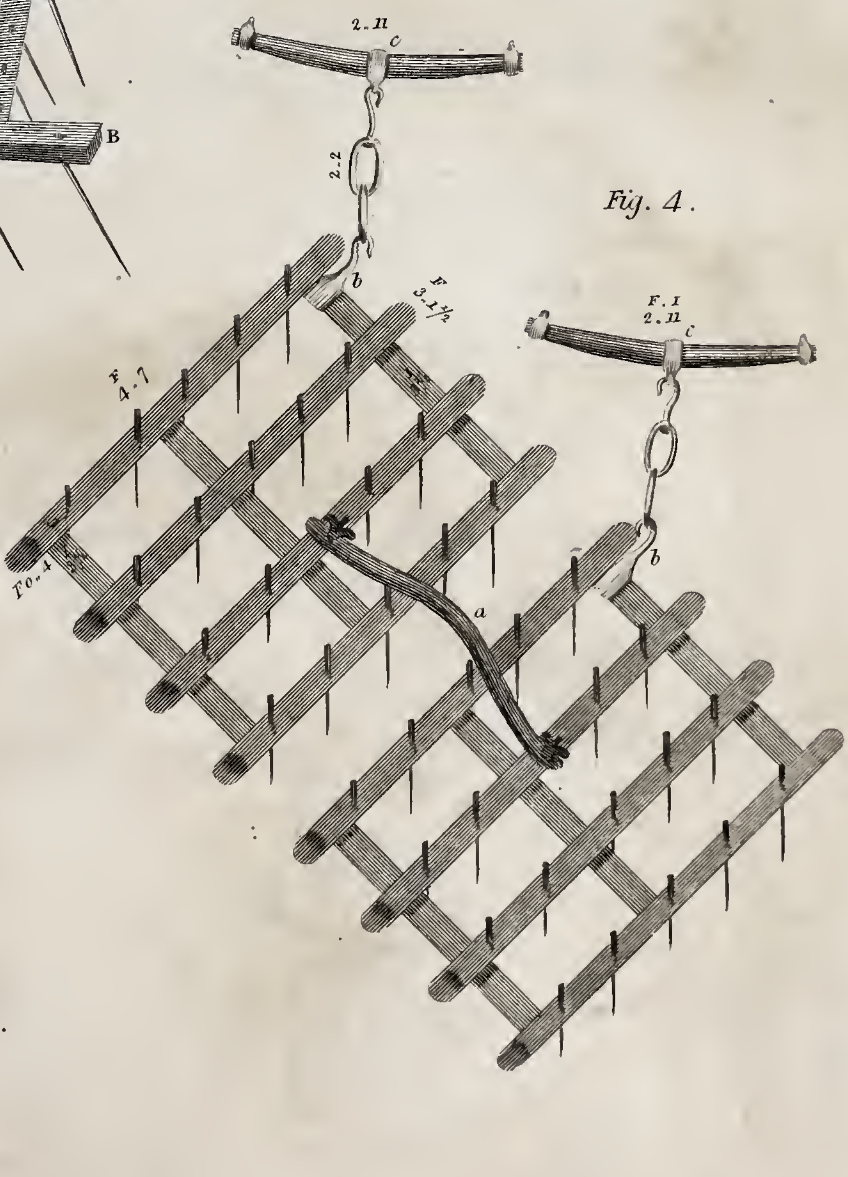
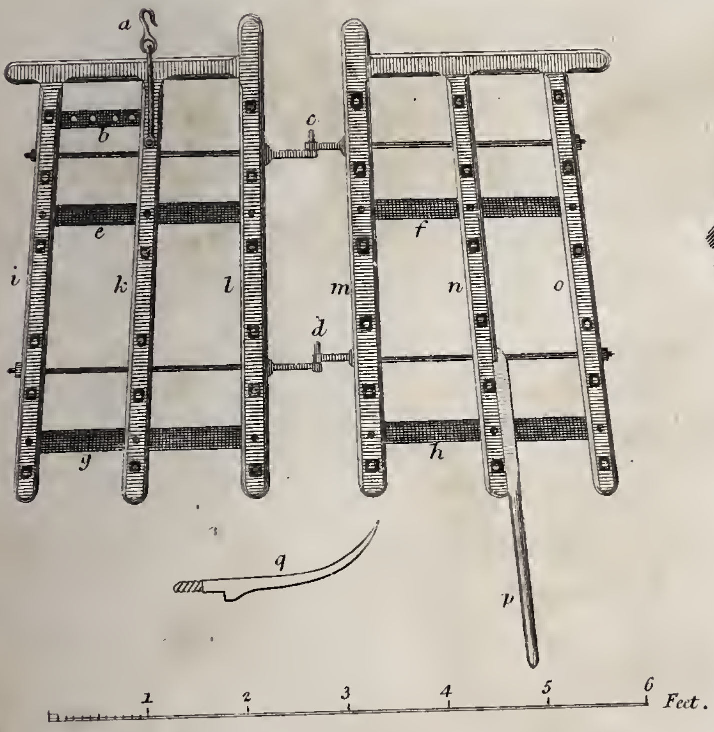
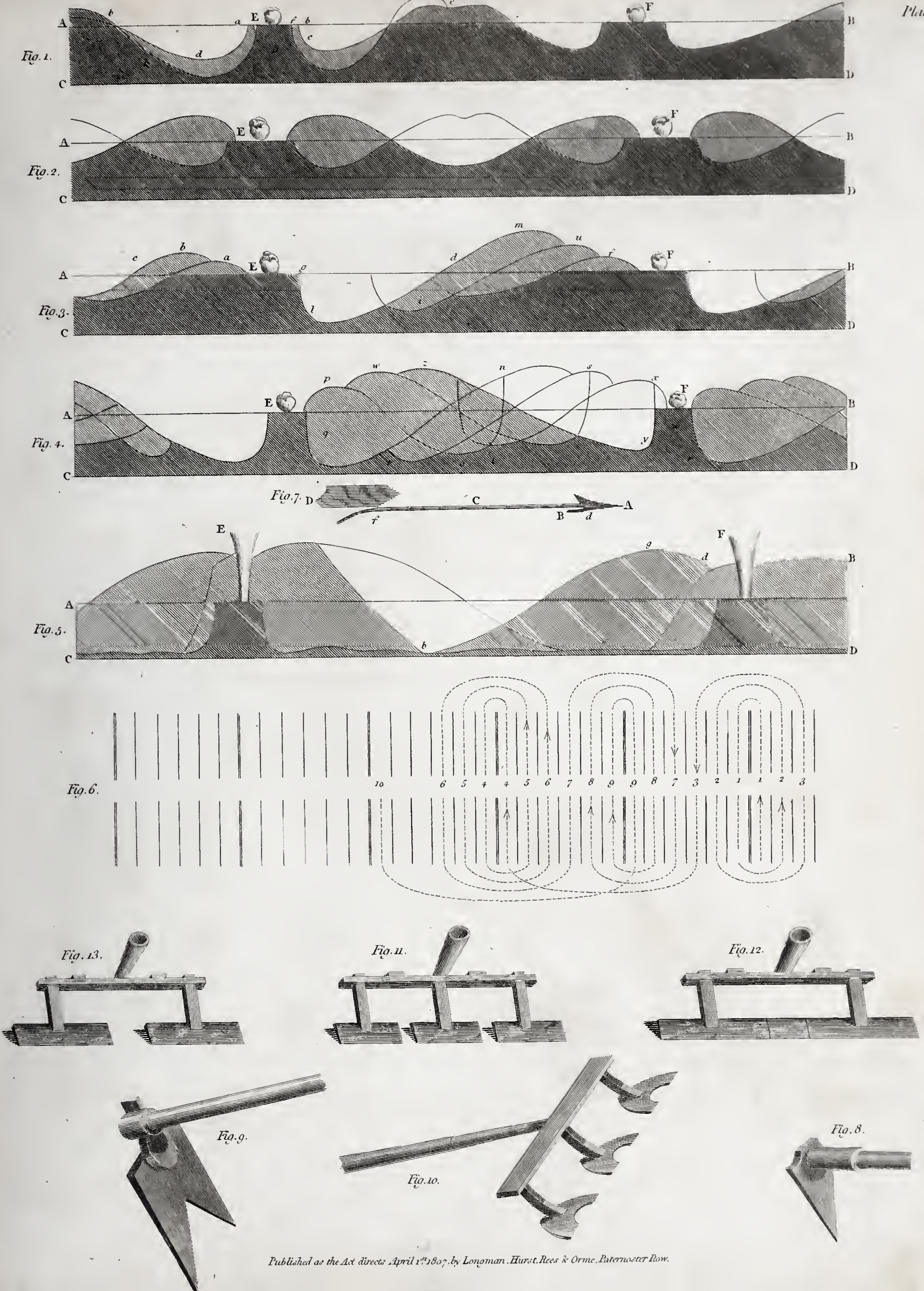


Fig. 3.



HAND HOES AND HOEING.

Plate LXVII



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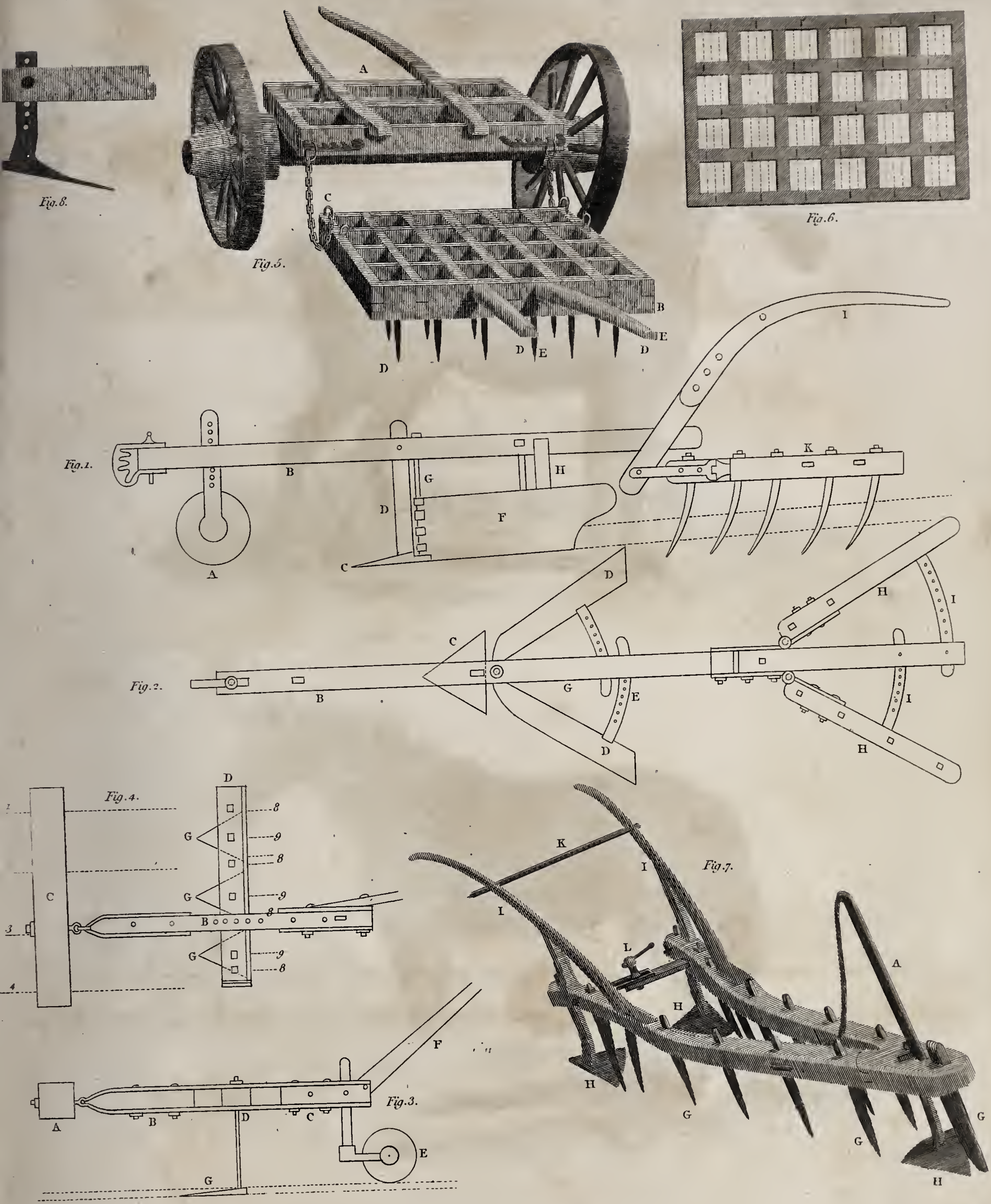
HORSE-HOES.



Drawn & Engraved by Plant.

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FARM HORSES.

Fig. 2.

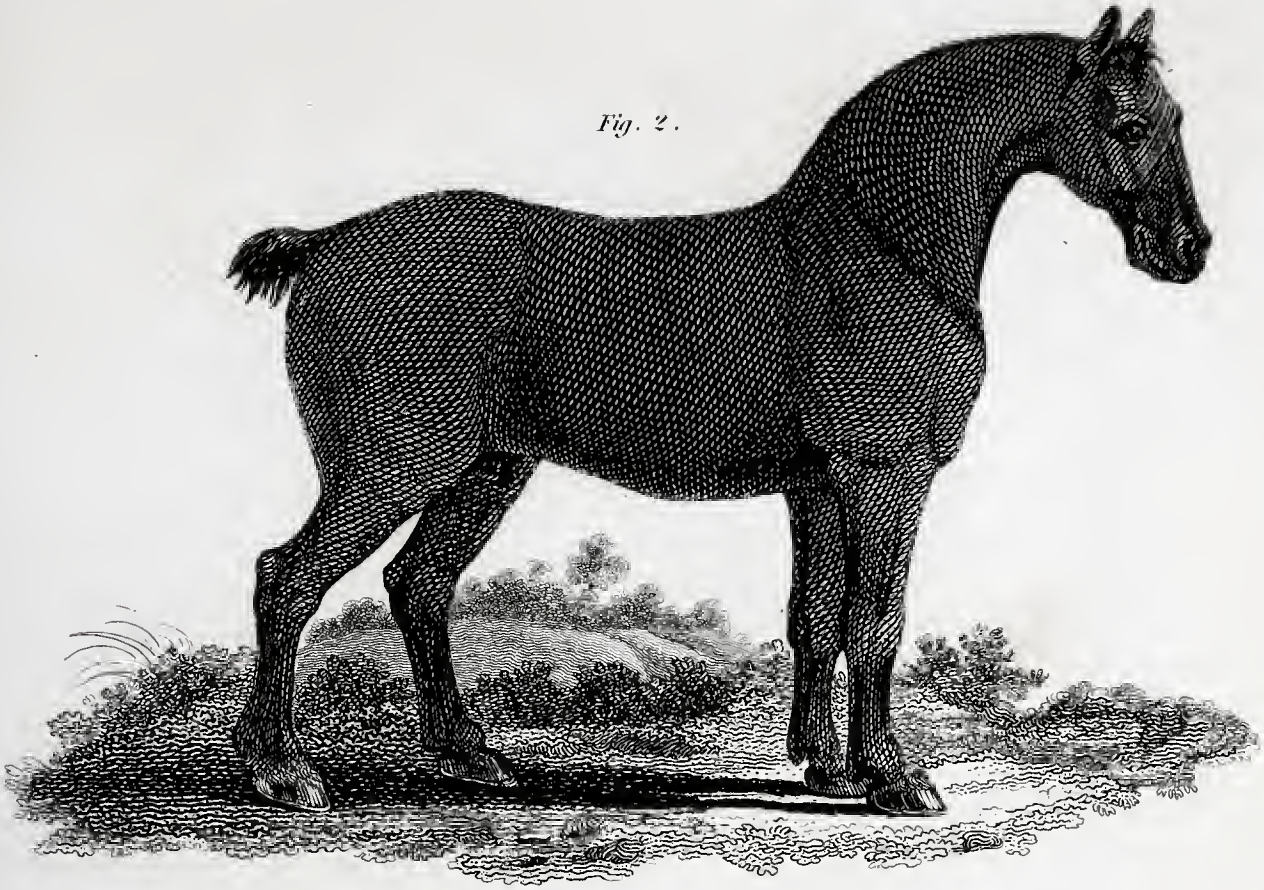
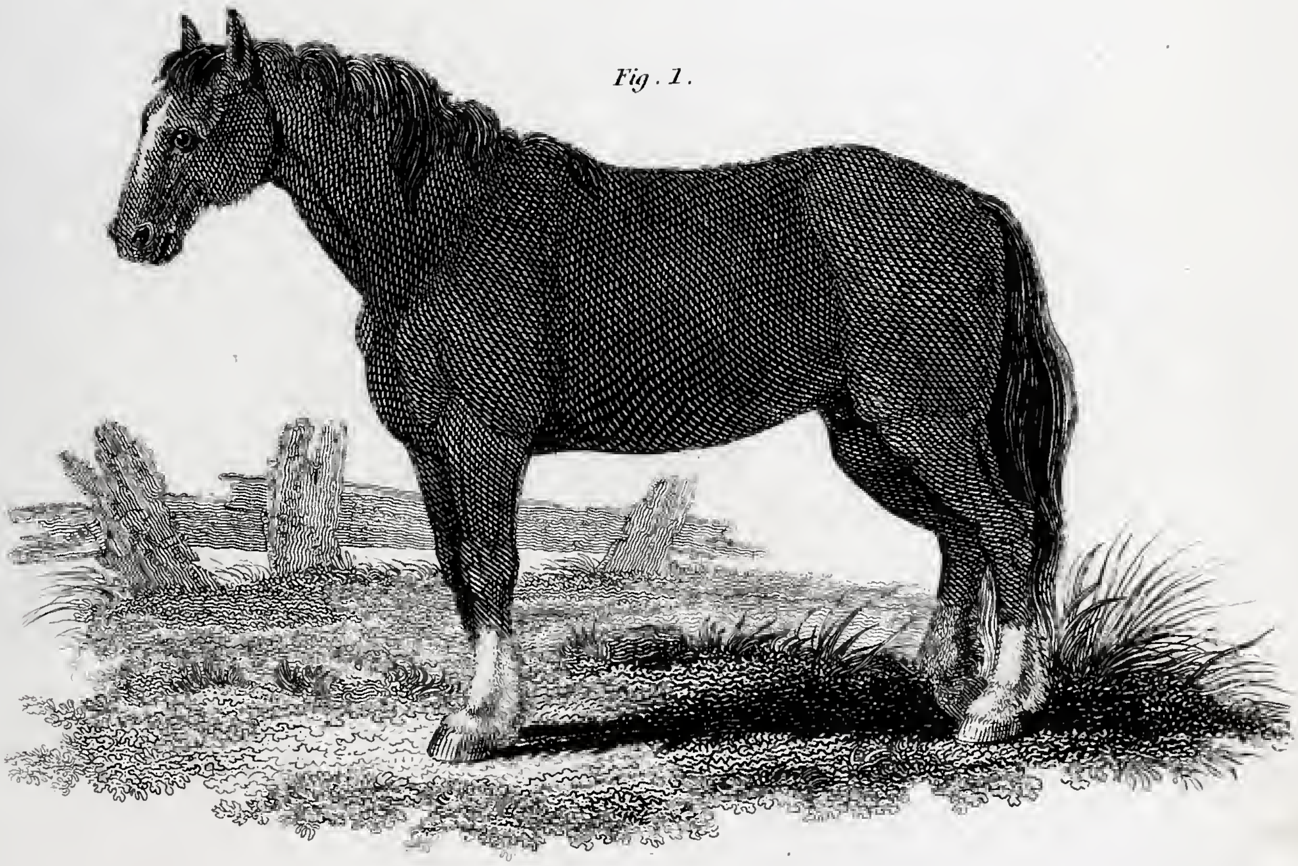


Fig. 1.



Scott sculp.